

ALEX<sup>R</sup>. WRIGHT & Co.,

→ GAS ENGINEERS, ←

55, 55a, & 56, MILLBANK STREET, WESTMINSTER, S.W.

TELEPHONE No. 3053.

JAMES W. QUEEN & CO.,

Telegrams: "PRECISION LONDON."

SOLE AGENTS,  
IN NORTH AMERICA,  
(DEPARTMENT NO. 4.)  
GOLD MEDAL,

INTERNATIONAL INVENTIONS EXHIBITION, 1885.



ILLUSTRATED AND DESCRIPTIVE

## PRICE LIST OF APPARATUS

FOR

ASCERTAINING THE ILLUMINATING POWER

AND FOR THE

ANALYSIS OF COAL GAS.

SOLE AGENTS IN AMERICA:

J. W. QUEEN & CO., OPTICIANS,  
PHILADELPHIA.

**J**GN issuing this section of our New and Enlarged Catalogue, we beg to thank our Friends for their support, and to assure them that no efforts will be spared in the future to merit the continuance of the same.

This section comprises Photometric and general Apparatus, for ascertaining the Illuminating Power and the Analysis of Coal Gas, &c.

In many instances the prices have been reduced, but in all cases the well-known excellence of our productions will be maintained. With a view to satisfying an increasing demand for our scientific apparatus, at home and abroad, we have laid down a large plant of power machinery embodying the latest improvements; and by careful personal supervision we feel confident, by this endeavour on our part, of not only maintaining our reputation of precision and excellence of manufacture, but, by the more speedy execution of orders intrusted to us, to satisfy to the fullest the requirements of our Friends.

Our Stock has been largely augmented in every department, and we can generally promise a very speedy delivery.

We remain,

Yours obediently,

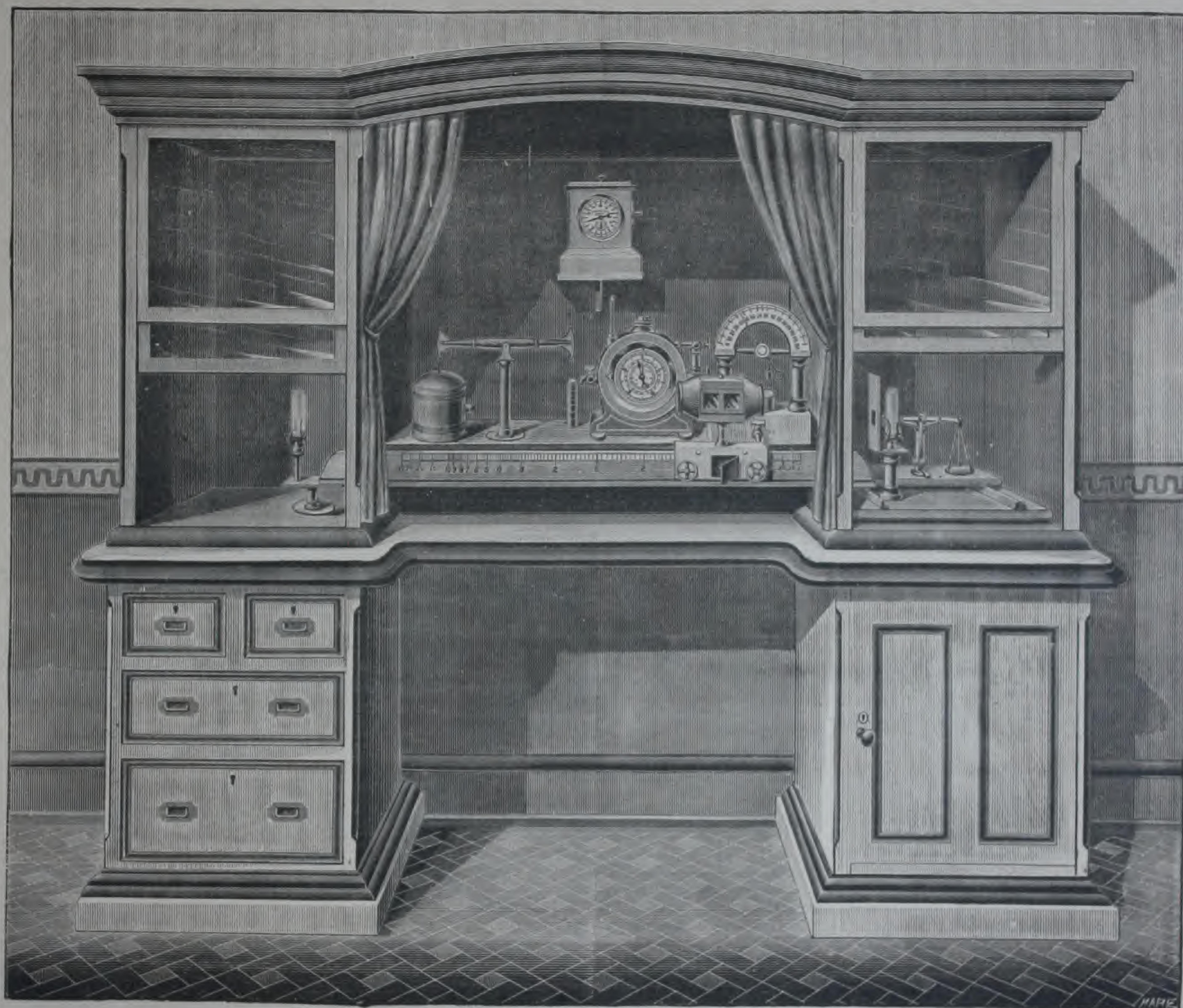
ALEX<sup>R.</sup> WRIGHT & Co.

Two-thirds allowed for returned packages, when actually received, carriage paid, and in good condition.

PREVIOUS LISTS CANCELLED.

# WRIGHT'S IMPROVED CABINET PHOTOMETER

(Letheby-Bunsen System).



This Apparatus has been specially designed as a Standard for Government Authorities, Gas Companies, Corporations, and others requiring a high-class instrument not necessitating the use of a dark room, and will be found to embody all the latest and most desirable improvements in the Letheby-Bunsen Photometer.

The Cabinet and Table is of an elegant design, and can be supplied in any class of wood to accord with the fittings of the room or office in which it is placed, and comprises: A Pedestal Table, fitted with cupboards and drawers as shown, the front and centre portion of the table top being recessed, and with the addition of the overhanging curtains, forms a space or dark chamber, within which the operator can conveniently conduct the experiments.

The whole of the pipes and fittings connecting the various apparatus together are arranged below the table top, and are supplied with "drip-cocks" for freeing them from condensation, &c. All cocks and valves are sunk flush in table, and are arranged in the most convenient positions for use.

The Scale is fitted flush in table, and the sight box carrying the disc traversed by endless cords actuated by winch handle. The sight box is fitted with angular reflectors for viewing the disc, and a small adjustable silvered reflector for illuminating the scale and index pointer.

The Chambers in which the standard Argand burner and candle balance are enclosed, are fitted with sliding frames carrying blue glass panels in front and metal draught proof ventilators at top.

The Candel Balance is made with steel knife edges (gilt to prevent oxidation) working on agate planes, and is provided with adjustable sliding weights to counterbalance the candles without the use of shot, the whole being fitted upon a stout base sliding on rollers, so that when the substitution of another standard light (such as a Methven screen) is desired, it may be rolled back out of the way.

A swing bracket carrying a Methven screen (or other standard) is provided and fixed as shown.

**Experimental Meter and Minute Clock** combined, with measuring drum 1-12th of a cubic foot capacity, accurately balanced and equalized in measurement in all divisions; central index with large enamelled dial, showing hourly rate of consumption by observation of one minute; delicate thermometer, Centigrade or Fahrenheit, improved water level gauge, water level adjustment and draw-off cock. The Minute Clock has Wright's self-winding attachment, driven by the meter, the construction of which ensuring very great accuracy, and entirely obviating the inconvenience due to experimental clocks in general, which on account of the short time for which they are made to go, often causing them to run down during the progress of an experiment. The clock movement is fitted with a jewelled balance of first quality, and has devices for starting, stopping, and resetting the hands to zero. The clock, although driven and wound up by the gas, will maintain its action for at least half an hour after the gas has been turned off.

The whole fitted in a handsome japanned case, standing on cylindrical pedestal, supplied with levelling screws, spirits, levels, &c.

**Experimental Balance Governor**, of sensitive construction, to maintain the gas at a uniform pressure, with lever beam counterpoise, the centres of which work upon anti-friction rollers, white metal bell and tank, equilibrium valve, and all latest improvements, finished in japan and gold.

**King's Gauge**, indicating to the 1-100th of an inch pressure, fitted with water level adjustment, enamelled dial, index centre working upon anti-friction rollers, compound valve arranged for testing the pressure at the inlets and outlets of the various instruments and at the point of ignition of gas burner, with index pointer and enamelled dial.

**Sulphuretted Hydrogen Test Glass** of best quality, consisting of a cylindrical glass, white metal base, and top, &c.

**Standard "London" Argand Burner**, with supply of chimneys fitted in mahogany box.

**Standard Barometer** of the best construction, tube  $\frac{1}{4}$ -in. internal diameter; scales with verniers graduated to show to 1-500th of an inch, and 1-10th of a millimetre, with delicate thermometer fitted on to a brass casing. The whole exquisitely finished and mounted on suspension board, furnished with enamelled glass reflectors at points of observation.

**Sundries**.—One pair burner pliers (bright steel); wooden pliers for taking off chimneys; 1 dozen each greased and Leeson star discs; japanned disc box, lettered in gold; japanned candle box, lettered in gold, containing supply of candles, 6 lbs.; forms for photometric observations; stand for chimneys; one leather buff; one chimney cleaning brush; one large wash leather; six cleaning cloths or dusters; six dozen acetate of lead papers.

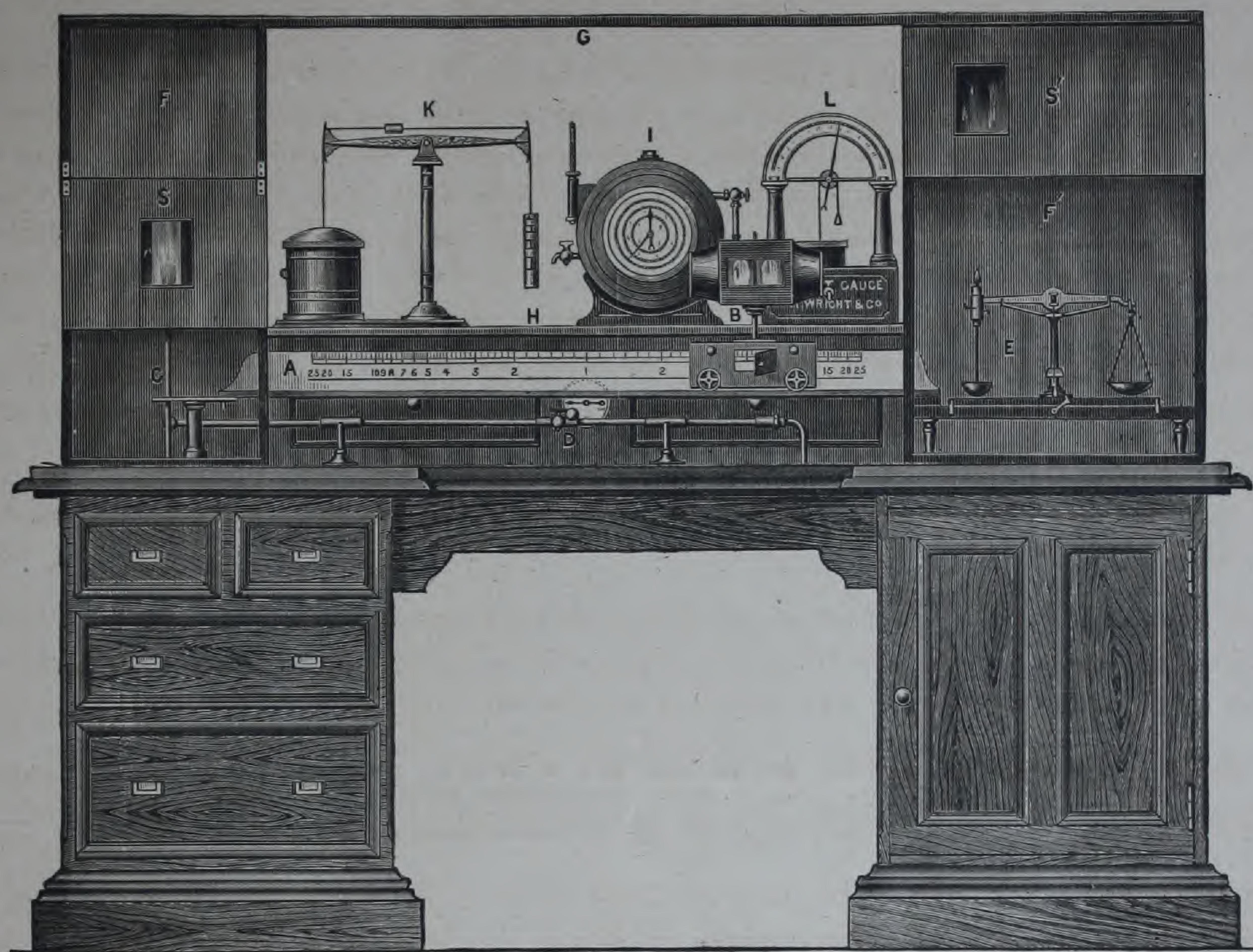
The whole Apparatus of the very best workmanship and finish, and guaranteed perfect in every respect.

Total cost delivered in London . . . . .	Net £115 0 0
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Packed complete and delivered f.o.b. London, Liverpool, or Hull, or to any Railway Station in England, 5 per cent. extra.

This Photometer is complete and perfect as sent out by us, and can be put together by any ordinary mechanic in the space of two hours.

# IMPROVED STANDARD LETHEBY-BUNSEN PHOTOMETER.



**Improved Standard Letheby-Bunsen Photometer**, consisting of two chambers to receive burner at one end and candle balance at the other; the chambers are provided with flaps carrying blue glass screens; accurately graduated bar of best French polished pine, improved sight box fitted with disc holder and plate glass reflectors, mounted on polished mahogany saddle, lined with velvet; gas pillar to receive burner; Hartley's candle balance arranged for weighing the candles while in position for use, with weights; four-way valve, with enamelled dial, by which indications of the gas pressure on the "inlet and outlet of meter," "outlet of governor," and at the "point of ignition" may be obtained with the King's gauge, and any obstructions in the connecting pipes ascertained, and the rate of consumption at the burner more readily adjusted; micrometer and stopcock, &c. The raised platform at the back between the two chambers forming a stand for the necessary instruments. The whole of the woodwork in very best pine, dull black inside and French polished outside; all pipes and joints to connect the various instruments together, and "drip-cocks" to run off condensed water . . . . . £27 0 0

**Pedestal Table**, made in best white pine, French polished, containing four drawers and one cupboard, all necessary holes being cut in the table to receive the photometer pipes, &c. . . . . 12 10 0

**Experimental Meter** with Central Index, showing hourly rate of consumption by observation of one minute measuring drum 1-12th of a cubic foot capacity, accurately balanced and equalized in measurement in all divisions; water line gauge; water level adjustment and draw-off cocks; delicate thermometer calibrated for Centigrade or Fahrenheit, in brass case affixed to outlet of meter. Handsomely finished in japan and gold . . . . . 8 8 0

**Experimental Balance Governor** of sensitive construction, to maintain uniformity of pressure, fitted with metal tank and bell, lever beam counterpoise, centre working on delicate anti-friction roller bearings. Finished in japan and gold . . . . . 4 4 0

**Improved Experimental Minute Clock**, of first-class construction, jewelled balance, striking action, and arrangement for stopping, starting, and re-setting hands to zero; enamelled dial, with two circles divided into seconds and .01 of a minute respectively. Mounted in polished mahogany or oak case . . . . . 11 0 0

**Sulphuretted Hydrogen Test Glass** of best quality, consisting of a cylindrical glass, with polished white metal top and base, two stoppers, and porcelain cups. Mounted on mahogany plinth . . . . . 3 3 0

In this instrument the gas is caused to impinge directly upon the test paper.

**King's Gauge**, indicating to  $1\frac{1}{2}$  in. pressure, on enamelled dial divided into 100ths of an inch, spindle of index pointer working upon delicate anti-friction roller bearings. Handsomely finished in japan and gold . . . . . 5 5 0

**Standard Barometer** of the best construction, scales with verniers, graduated to show 1-500th of an inch, and 1-10th of a millimetre; delicate thermometer, fitted on brass casing. The whole mounted in polished case, and provided with reflectors at points of observation . . . . . 7 10 0

**Service Governor**, to prevent excessive pressure acting upon the balance governor, strongly made in stout sheet iron, with weights for adjustment . . . . . 1 15 0

**Sundries**.—Consisting of japanned box, with cells to contain "dises," "test papers," and "shot"; brass sockets for union and other jets; six pounds of standard sperm candles; 1 dozen Bunsen or Leeson star discs; 3 chimneys, 6 in. by 2 in.; 3 chimneys, 6 in. by  $1\frac{1}{2}$  in.; stand for chimney; wooden pliers for removing chimneys from burner; dolly and leather for cleaning chimneys; 3 dozen test papers for sulphuretted hydrogen test; parliamentary standard Argand burner . . . . . 4 10 0

Total cost delivered in London . . . . .

£85 5 0

Packed complete, and delivered f.o.b. in London, Liverpool, or Hull, or to any railway station in England, 5 per cent. extra.

If fitted with Methven's Light Unit, in addition to the candle balance, extra, as per page 10 . . . . .

7 10 0

The importance of correcting the bulk of the gas measured by an experimental meter for barometric pressure, and for temperature will be best realized by an extreme illustration. "Suppose, then, that gas were adjusted to burn at the 5 cubic feet rate [per hour from the photometer burner] when the barometer was at 28 inches and the temperature 84° Fahr., the table [of volumes] shows that the measured volume is only 870-1000ths of the nominal volume, or 4·35 instead of 5 cubic feet."—Hartley's Gas Analyst's Manual.

Thus if the gas at normal pressure and temperature (30 inches and 60°) were really 15-candle power, it would at 28 inches and 84° in the absence of corrections appear to be less than 13-candle power. No mention of corrections is made in the Gas-Works Clauses Act, but every fair and intelligent official gas examiner will be willing to make such corrections if a barometer and thermometer be placed at his disposal.

# STANDARD LETHEBY-BUNSEN PHOTOMETER.



JAMES W. QUEEN & CO,  
SOLE AGENTS,  
IN NORTH AMERICA,  
(DEPARTMENT NO. 4)

Standard Letheby-Bunsen Photometer, including Hartley's candle balance E, for weighing candles while burning and in position for use; gas pillar C, and small gauge; micrometer cock D, improved disc box with reflectors on saddle B, fitted with brass rollers sliding on graduated scale base A, mounted on base board G, and with four Lethaby screens 1, 1', 2, and 2'.

Pine Table, as drawing, French polished and fitted with all pipes and connections £16 10 0

Experimental Meter, central index, hourly rate shown by one minute's inspection, with water level gauge, draw-off cock and thermometer. Finished in japan and gold 10 0 0

Experimental Governor, of the most sensitive construction, to maintain uniformity of consumption; finished in japan and gold, and mounted on polished mahogany stand 8 8 0

Improved Minute Clock, with striking action, and arrangements for instantly starting and stopping, and for setting the hands up. In polished wood case to stand on table 4 4 0

Sulphuretted Hydrogen Test Glass, best quality, with metal base and top, mounted on mahogany plinth 11 0 0

*In this instrument the gas is caused to impinge directly upon the test papers, efficient action being thereby secured.*

King's Gauge, indicating to 1-100th inch pressure; for application to photometer burner, to show pressure at point of ignition, and to facilitate adjustments of rate of gas consumption 4 0 0

Service Governor. To prevent excessive pressure acting upon the experimental governor, and thereby ensure greater regularity of gas consumption 1 15 0

Barometer, pediment with two verniers 5 10 0

This pediment barometer is a very superior kind of instrument, and as it indicates variations of atmospheric pressure to the 1-100th of an inch of mercury it completely suffices for gas volume corrections. The scale is compensated for variation in the level of the mercury in the cistern, so that no corrections have to be made in this respect. When extreme accuracy is desired, a standard barometer should be had, enclosed in a glass case.

Sundries, as per page 4 4 10 0

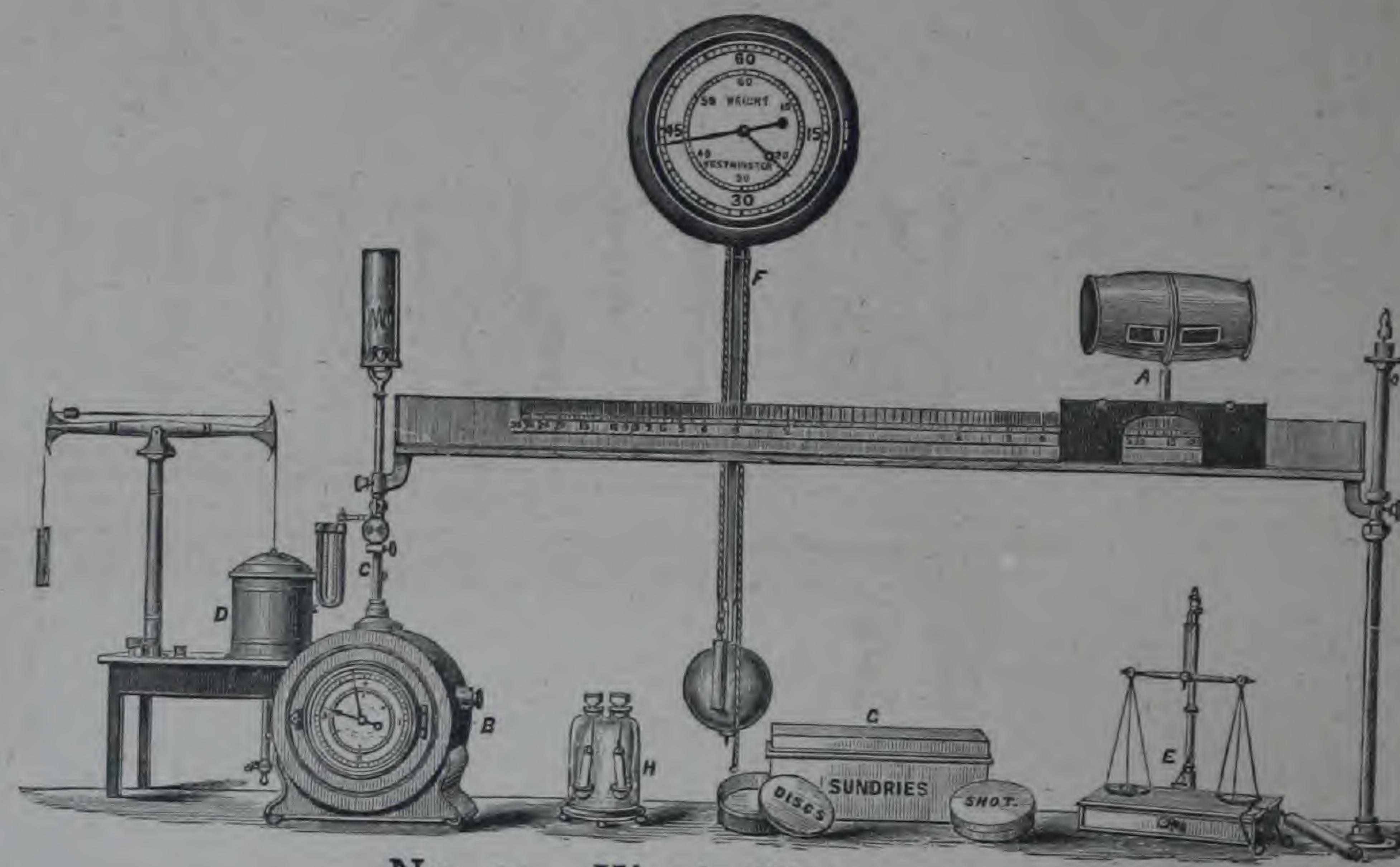
Total price complete, and delivered in London or district £69 0 0

Packed and delivered f.o.b. London, Liverpool, and Hull, or to any town in England, 5 per cent. extra.

Methven's Light Unit, extra, as per page 10 7 10 0

# PHOTOMETERS FOR OTHER PURPOSES THAN OFFICIAL TESTINGS.

These Photometers are all based on Bunsen's method, and are made with Wright's scale, the opposed lights being placed at each end of the bar. They are less elaborate than the preceding examples, and are employed by burner makers, candle and lamp manufacturers, and frequently by analysts for the purpose of ascertaining the illuminating power of gas from coals experimentally carbonized in small quantities, but cannot be legally employed in official testings.



No. 14.—King's Photometer.

**King's Photometer** (60, 75, or 100 inches in length.) Slide without rollers, disc carrier, and conical cover (without reflectors) and candle pillar . . . . . £3 15 0

Experimental Meter, with micrometer pillar and pressure gauge, and water level indicator, B and C . . . . . 7 4 0

Experimental Governor . . . . . 4 4 0

Pendulum Clock, mahogany case, glass front, 39 inches pendulum, beating seconds, and striking each minute . . . . . 5 10 0

Japanned Box . . . . . 1 5 0

Scales and Weights, 1-10th to 600 grs. . . . . 3 0 0

Brass Sockets . . . . . 0 8 0

Sperm Candles (6 lbs.) . . . . . 0 18 0

Discs, half-dozen . . . . . 0 6 0

Standard "London" Argand Burner and Chimney . . . . . 0 10 6

Total . . . . .	£26 15 6
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Packed and delivered f.o.b. London, Liverpool, or Hull, or to any town in England, 5 per cent. extra.

**Bunsen Photometer**, similar to that represented in fig. 14, with *gas pillar* (fitted with micrometer cock and pressure gauge), and also a sliding pillar, to enable the operator to keep the candle at the proper height; candle-holder for one candle, and candle-holder for two candles . . . . . 6 0 0

This Photometer is supported above the Table independently of the meter; this last will not therefore need a pillar. It is frequently used by candle, lamp and burner makers. The candle-holders are moveable, and can be placed in a scale-pan, so that the weighings can be done without taking the candles from the sockets.

**Other Instruments** as in preceding list.

## PHOTOMETERS FOR VARIOUS PURPOSES AND WITH SPECIAL APPLIANCES TO ORDER.

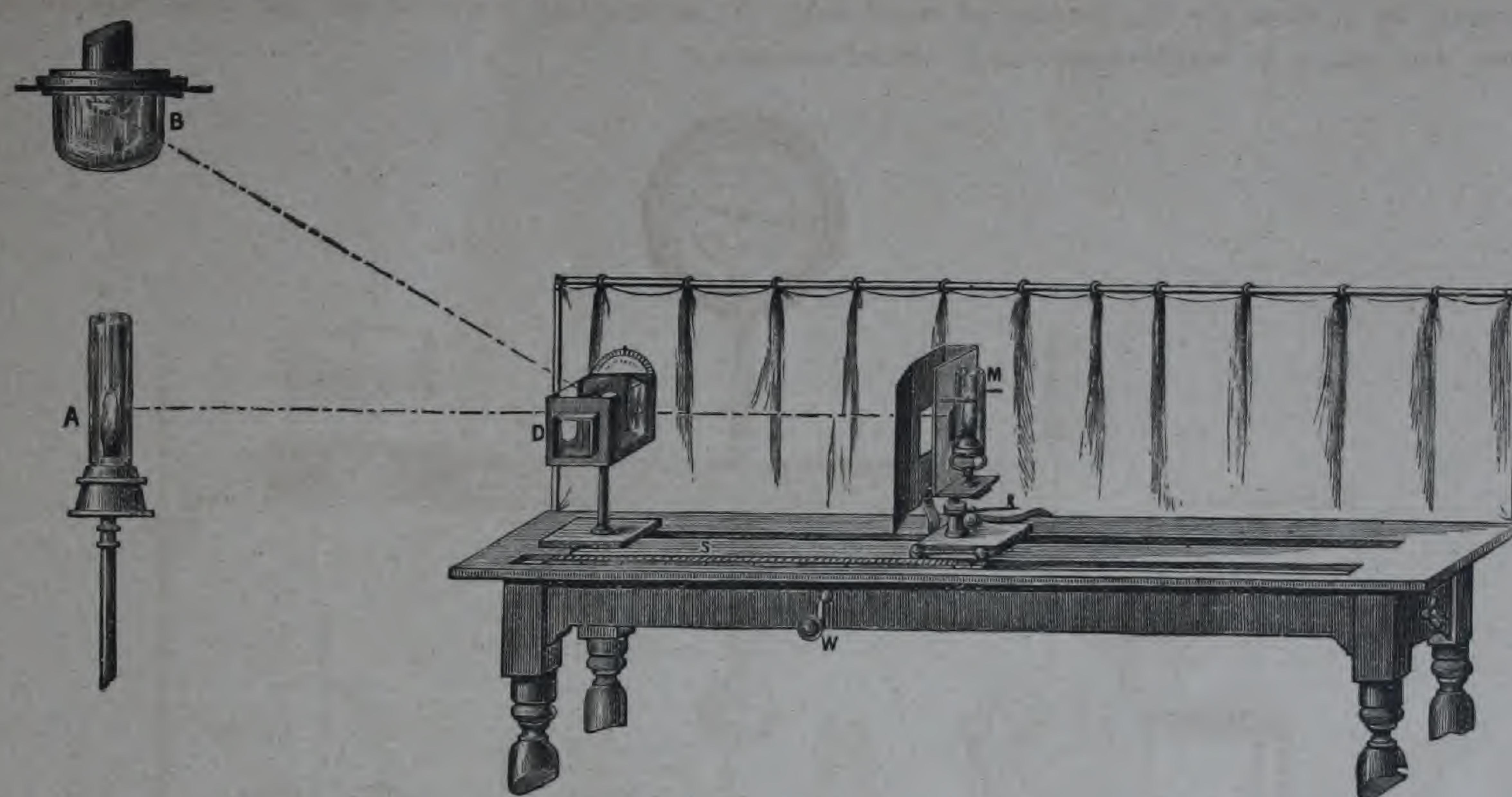
*Full instructions with tables are given in "The Gas Analyst's Manual," Price 5s. Od.*

By F. W. HARTLEY, A. Inst. C.E.

**Standard Letheby Photometers** of the most improved construction, with Dark Chambers to obviate the necessity of excluding daylight from or the extinction of Artificial Lights in, the Operating Room.

COMPETENT MEN SENT TO FIT AND START PHOTOMETRIC APPARATUS INTO WORKING ORDER WHEN REQUIRED.

## F. W. HARTLEY'S "UNIVERSAL" BUNSEN PHOTOMETER AND ANGLE MEASURER.



Gives results as accurate as are obtainable with the best Bunsen Photometer extant, is portable and capable of being promptly set up for use. It consists of a light narrow table, constructed and furnished as follows:—It is 11 in. wide, 2 ft. 6 in. high and 5 ft. 6 in. in length. It has a scale (**S**) of inches and tenths, the length of which is 21 in., fitted into and capable of being shifted and fixed at any needful position within a groove in the table top, which has a long slot along its centre, below which slot is a brass socket connected by wire cords passing over pulleys to the winch handle (**W**), so that by turning the handle the socket may be caused to traverse forward and backward in the direction of the length of the table.

The socket serves to receive the projecting plug of a metal carriage, on rollers, which runs freely upon the table. Upon this carriage is placed the standard light, with which other lights are to be contrasted. Such standard light may be that evolved from one or two sperm candles, from a suitable lamp, or, as shown in the woodcut, from a Methven Screen (**M**).

The disc carrier is supported on a stand, as shown at (**D**), the base of which is fitted with a pointer or index, coinciding with the vertical line of the disc.

The disc carrier, like the scale, may be shifted along the table and both must be shifted at the same time, *the index of the disc carrier and the zero of the scale always being made to cut, or coincide with each other*. There are three marked positions on the table for the zero of the scale and index of the disc carrier, viz.:—one nearly at the extreme left hand end of the table, another at 10 inches nearer the centre, and a third still nearer the centre by 20 inches.

With the photometer a strong sliding pillar is provided, the upper part of this is shown at (**A**) in the woodcut. The pillar, like the photometer, stands upon the floor and is provided with levelling screws, and with plumb lines. This pillar serves to carry gas burners or lamps of various sizes, from the smallest up to such as are of considerable dimensions and lighting power.

**Price of Hartley's Universal Photometer**, packed in deal box lined with green felt and fitted with strong handles for carrying, including Methven's Light Unit, velvet curtains, and strong sliding pillar with plumb bobs and gas connections, also Angle Measurer and five sets of Scales . . . . . £35 0 0

Experimental Meter, Governor, &c., extra.

We have sold a large number of these photometers and find them meet with universal approval, more especially by those requiring to test large and powerful lights either in or outdoors. They can be constructed specially for testing Electric Arc and Incandescent Lamps, and we are prepared to supply and fit them with all the necessary apparatus for this purpose.

## METHVEN'S ILLUMINATING POWER OF GAS.

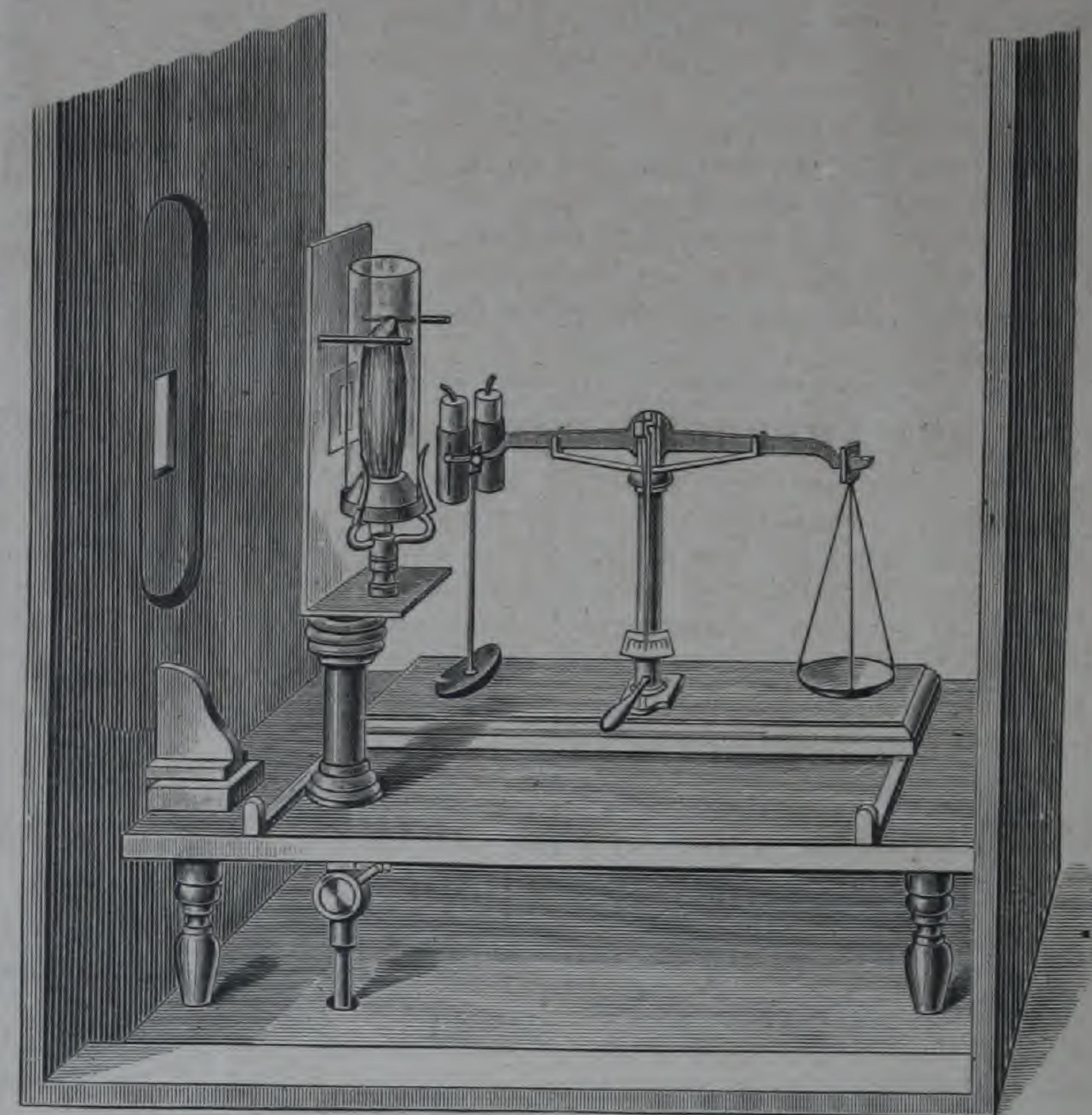


Fig. 1.

### STANDARD FOR USE WITH COAL GASES RANGING IN ILLUMINATING POWER FROM ABOUT 15 TO 20 CANDLES.

This consists of an upright rectangular metallic plate or screen, having a horizontal flange or bracket, upon which a Standard London Argand Burner is fixed, the latter being supplied with gas through a plug or nosepiece projecting downwards. The upright plate has a slot or hole above the flange or bracket, and this hole is covered by a thin silver plate, having a vertical slot of such dimensions, as to allow of the passage of as much light as equals that afforded by two average Standard sperm candles, when the Argand burner is delivering sufficient gas to give a flame three inches in length. The positions for the burner and for the slotted plate have been exactly determined, and are absolute and unvarying with every "Standard."

The illustration, fig. 1, shows the application of the "Standard" to a modern and improved "Lethaby" photometer. The "Standard" is supported on a pillar which fits into a socket let into a wide stool, and is connected below with a gas-supply pipe, furnished with a good stopcock, or better, with one provided with a micrometer. The stool supports one end of the photometer bar, and is fitted with cross rails, on which the table of the candle-balance runs. As shown in the illustration, the "Standard" is in position for use, and the balance is pushed back out of the way. When it is desired to use the candles, the gas is turned off from the "Standard," and the latter with the pillar removed—an operation occupying less than a minute—the candle-balance is drawn forward until it is caught and held firmly in position by two spring catches. This arrangement is very convenient, as by keeping the candles burning, transitions from candles to the "Standard, and vice versa, can be readily effected.

### STANDARD FOR USE WITH CARBURETTED GASES.

With the Methven "Standard" just described, the amount of light delivered through the slot diminishes slightly when the quality of the gas burned falls much below 15-candles power, and increases a little when the gas is above 20-candles power.

These facts led Mr. Methven to enter upon a long series of experiments, in order to ascertain what effects result from carburetting coal and other gases of widely different illuminating power with *gasoline*, i.e., with light petroleum spirit having a boiling point below 120° Fahr. (49° Centigrade), and he found—first, that all the carburetted gases were too rich to be burned properly from a Standard Argand, furnished with a 6 by 2 inch chimney, with a greater flame length than 2½ inches; and secondly, that with that length of flame the amount of light yielded was constant and altogether independent of the actual illuminating power of the coal and cannel gases employed.

The entire flame is, however, disqualified for serving as a "Standard" or Light Unit, owing to the extreme nicety of adjustment which is needful and the time which such adjustment demands, as it is also by certain other circumstances. Mr. Methven, therefore, determined the size of, and the position for, a slot—shorter and wider than the original one—which allows of the passage of the light of exactly two Standard sperm candles from a 2½ inch flame, produced by the combustion of common or cannel gas which has traversed his carburettor.



Fig. 2.

The METHVEN STANDARDS can now be had fitted with a slide which carries a long slot for plain gas or carburetted gas, the 2½-inch and 3-inch lengths for flames being indicated by double sets of bars.

The CARBURETTOR, see fig. 3, may be conveniently placed upon the photometer bench. It is a singular box, furnished with a water-cistern and fitted with a bye-pass arrangement of cocks, so that when to the gas-pipe which supplies the Methven "Standard" plain gas or carburetted gas may, as desired, be employed. The water cistern prevents the undue cooling of the gasoline which would otherwise result from its evaporation.

Gases which, uncarburetted, have ranged in quality from 5-candles to over 35-candles power, have been proved, after carburation, to deliver the same amount of light through the slot of the "Standard," while the indicated photometric powers of opposed flames have been found to be the same when contrasted with the light from the carburetted and from the uncarburetted "Standard"; the gas employed with the latter being of the ordinary London quality.

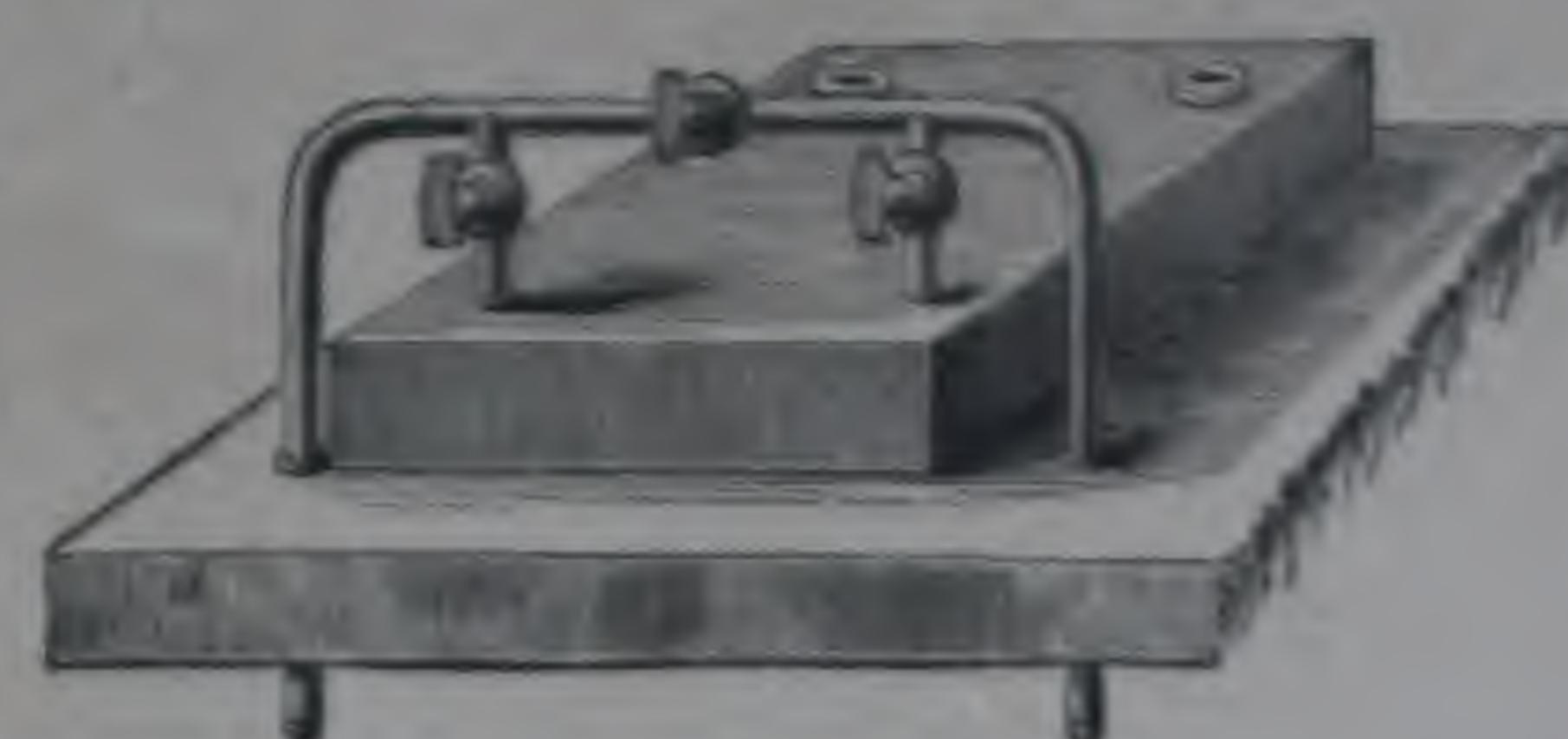


Fig. 3.

### WRIGHT'S PATENT IMPROVED VARIABLE METHVEN'S "SCREEN."

In consequence of a demand for a "Standard" of a higher and variable illuminating power, we have produced a modified form of screen, applicable to the "Methven" Standard. The screen is provided with a rectangular aperture, which aperture may be increased or decreased in area, allowing more or less light to pass through than that afforded by two Standard sperm candles. This variation in area is effected by means of a vertical slide, which being opened in the centre, forms a frame surrounding the aperture in the screen. A screw, mounted in fixed bearings, and engaging with the lower member of the frame, the slide is thus able to be moved either upwards or downwards. The two shutters are mounted horizontally in bearings, so as to approach or recede from the centre of the aperture by means of pins and inclined slots. The upper member of the frame shows, against a scale marked on the screen, the number of candles the Standard is adjusted to.

### INSTRUCTIONS FOR USING METHVEN'S "STANDARD."

BY F. W. HARTLEY.

1st. The position of the centre of the burner of the "Standard" must coincide with a cross line, which would cut the centres of the flames of the candles when they are in position for use. This position, with a Letheby photometer, is 30 inches from the centre of the graduated bar.

2nd. The face of the "Standard" must be at a right angle with the line of the bar; any considerable divergence will lead to grave errors.

3rd. The centre of the slot of the "Standard" must be as nearly as possible in a horizontal line with the centre of the photometer disc.

4th. The "Standard" must be upright, although if a 32nd of an inch out of the perpendicular, little or no ill will result.

5th. The chimney used must be 2-inch diameter and 6 inches long, and must be cleaned tolerably often, and for exact experiments be cleaned on every occasion before using.

6th. Horizontal wires are fixed to the "Standard"—viz., at 8 inches above the top of the burner for plain gas, and at 2½ inches above the burner for carburetted gas. The top of the flame should just reach the level of the wires; but if, as is generally the case, the top of the flame is somewhat irregular, its extreme points should be allowed to extend above the wire by about 1-8th of an inch.

7th. When adjusting or observing the flame-length, look through deep blue glass, or the eyes will for some time be unfitted for exactly estimating the equal illumination of the sides of the disc.

8th. The flame-length of the "Standard" should be observed at short intervals, and re-adjusted if needful, especially if the gas supply is not controlled by an experimental governor. As a testing with the "Standard" can be completed in five or six minutes, the little time and trouble demanded to maintain the "Standard" flame right can be well afforded.

9th. Take no reading with the photometer until the "Standard" is hot; with a 3-inch flame it will become hot in about five minutes.

10th. In comparing the results obtained with candles, and those obtained with the "Standard," it must be remembered that the power of the "Standard" represents the average of the powers of very many candles which burned well, but differed in illuminating effect. Thus, as against a series of candles, the apparent value of a "Standard" ranged from 1·878 to 2·067 candles, the differences being wholly due to the variations of the candles.

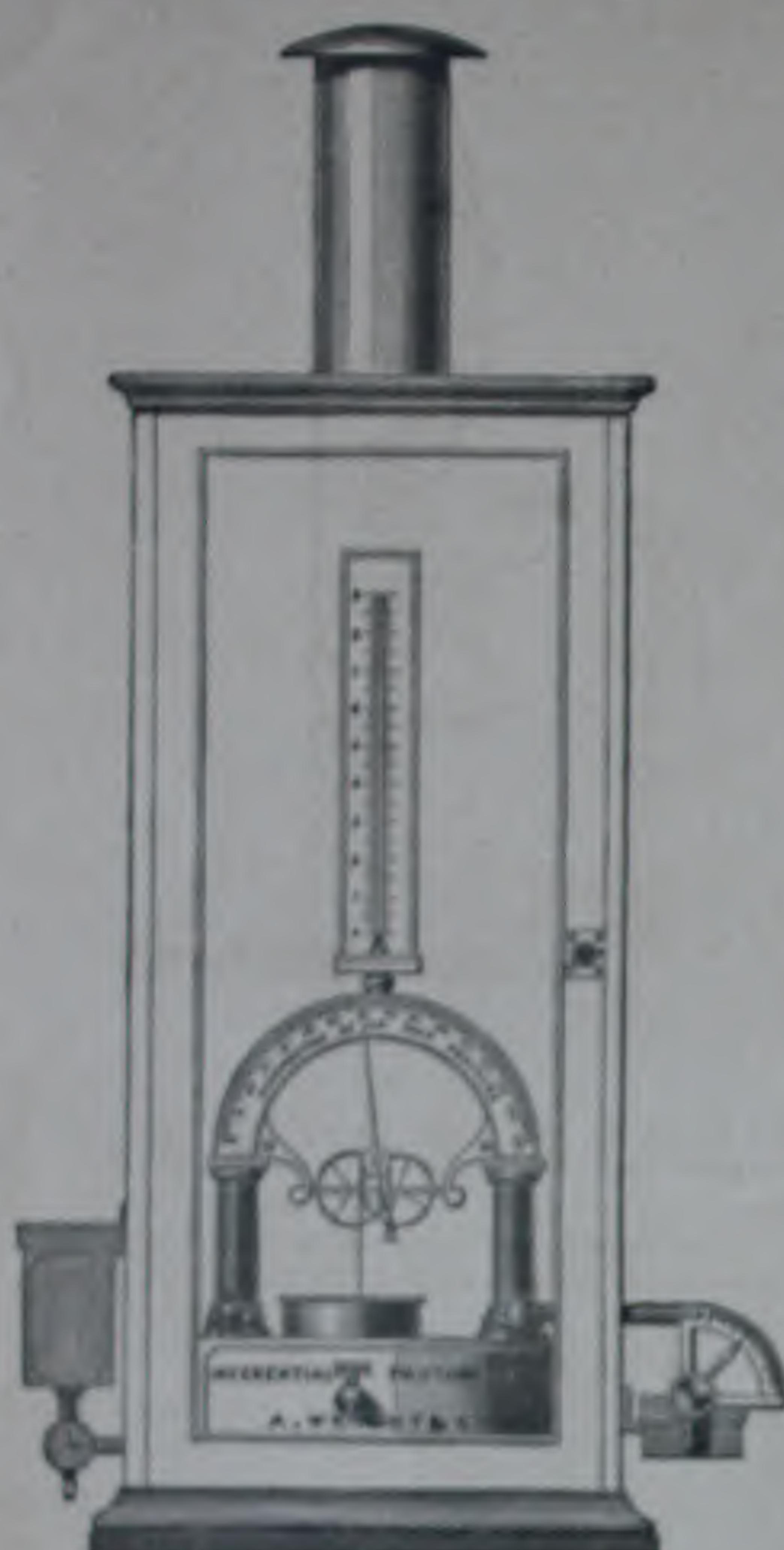
11th. It will be observed in the illustration that the wide opening in the upright wood screen of the Letheby photometer is partly closed by a secondary screen when the "Standard" is used. This secondary screen is pierced with a smaller hole, 2 inches wide and 2½ inches long, exactly opposite the slot of the "Standard." This secondary screen is essential when the "Standard" is employed with a Letheby photometer, and may consist of a blackened board suspended from a hook in the larger screen, so as to be easily removable when candles are to be used.

Methven's "Standard," as usually made, is of the form shown in the illustration, and is provided with a socket screwed externally, so that it may be fitted to a pillar or other support, but the "Standard" will be made to order to suit any Bunsen photometer for about the same prices as under A, B, and C in the annexed List.

	£ s. d.
A1.—Wright's Improved Methven's "Screen".	10 10 0
A.—Methven's "Standard," fitted with slotted Silver Plate, Plug for Gas connection, and Duplicate of the Certified Standard "London" Burner and Chimney.	4 15 0
B.—As above, but with a Pillar in addition for supporting the Screen on the Balance Table, as shown in illustration, fig. 1.	5 5 0
C.—As B, but with Micrometer Cock on Pillar for the adjustment of the height of the flame.	6 0 0
D.—As C, with BROAD TABLE fitted with CROSS RAILS, improved CANDLE BALANCE fixed on stout slab, provided with rollers so as to run upon the rails of the table—as shown in the illustration fig. 1—with box of best weights, complete.	13 15 0
E.—Methven's Carburettor, fig. 3.	1 5 0
F.—Rectified Petroleum Spirit, per pint, inclusive of metal bottle with screwed stopper.	0 7 6

Every "Standard" is tested before being sent out, and is accompanied by a Certificate, signed by Mr. Methven and by the Firm.

## WRIGHT'S IMPROVED LOWE'S JET PHOTOMETER.



Photometer, consisting of a King's gauge, indicating to 1-100th of an inch pressure, mounted with jet and graduated glass scale, the gas pressure controlled by a double dry governor attached to the gauge . . . . .

5 0 0

Photometer, consisting of gauge, jet, scale, and governor as above, but enclosed in a glazed case, surmounted by a copper chimney . . . . .

7 10 0

Photometer, consisting of gauge, best make, with large anti-friction wheels for spindle to turn upon, jet and scale, double dry governor and micrometer cock, water-level adjustment and water tank, glazed case, &c. . . . .

12 5 0

These instruments indicate variations in the illuminating power of gas, and although exceedingly useful to gas manufacturers, are not fitted to be used as substitutes for a standard photometric apparatus.

### DIRECTIONS FOR FIXING.

Have it placed perfectly level upon a firm base so as not to be affected by vibration or other causes.

Fill the tank of pressure gauge with water up to the overflow line, and also the brass tank of water regulator.

Place the index pointer upon its centre, and hang on the float so that it falls to the left side of wheel, and let the balance-weight cord have one turn round the wheel in opposite direction.

Hold the wheel with the thumb and finger of one hand, and shift the pointer (which is only friction tight on the shaft) with the other, till it stands at zero, taking care that it works freely on its centres.

Turn on the cock between the well of the pressure gauge and the brass cylinder fixed on the left side of the instrument, which latter is the water-line regulator; when this cock is open the water in the cylinder rises to the height of that in the well. A plunger which nearly fits the cylinder is attached to the cover of the latter by means of a fine-screwed piston-rod terminating in a milled head. If it is made to descend into the water it causes a displacement equal to the bulk of that portion which is forced below the water-line, and the water displaced goes into the well of the pressure gauge, moving the pointer in the direction above zero. If, on the other hand, the plunger is raised out of the water in the cylinder the bulk withdrawn is immediately replaced by water from the well of the pressure gauge, and the pointer is moved in the direction of zero.

**Note.**—The alteration of the water-line is caused by evaporation, but the position of the pointer is sometimes altered by the effect of the atmosphere on the float-line.

The pointer having been properly adjusted, the communication between the well and the water line regulator is closed, and must not be reopened until it is required to make another adjustment of the pointer.

Connect the apparatus with the gas and adjust the double governor by turning on the regulating cock, lighting the jet, and weighting down the gas-blower nearest it to give 9 or 10 tenths of an inch pressure. Then regulate the flame to the 7-inch mark. The pressure required to give a 7-inch flame is an index to the illuminating power—thus, 16-candle gas will give the standard 7-inch flame at '68 of an inch pressure at the point of ignition, as shown on the dial. 14-candle gas requires '68 of an inch to give the standard flame.

Every Instrument we make is carefully tested and adjusted by a competent person before being sent out, and is perfect in every respect.

Small Cylindrical Sheet-Iron Purifiers for extracting CO<sub>2</sub>, for use with the above apparatus, made to order.

## SULPHUR TESTING APPARATUS.

JAMES W. QUEEN & CO.,  
SOLE AGENTS,  
IN NORTH AMERICA,  
(DEPARTMENT NO. 4.)



One "Gas Referees" Sulphur Test, complete, consisting of one condensing cylinder, filled with about 200 glass balls, one trumpet tube, one long straw tube, one burner with perforated regulator for the admission of air, steatite tip and table for carbonate of ammonia. One polished mahogany stand, one beaker for collecting liquid from the condensing cylinder, one glass tube, with india-rubber connections for attaching to the bottom of condensing cylinder to convey the condensed liquid into the beaker, two india-rubber connections, one for trumpet tube, and the other for straw tube

3 10 0

One experimental Meter with stop action to shut off when 10 cubic feet of gas have passed through it—capacity of measuring drum 1-10th of a cubic foot—the index showing from the 100th of a foot to 100 cubic feet, and fitted with a levelling plate, glass water-line gauge and thermometer box, japanned, complete . . . . .

10 10 0

The above without Stop Action, £6 10s.

One Thermometer in brass case for ditto . . . . .	0 12 6
One small Spirit Level for ditto . . . . .	0 6 0
Twelve feet red india-rubber Tubing ( $\frac{3}{8}$ -inch) . . . . .	0 9 0
One Balance in glass case to turn with 1-200th of a grain, and carry a weight of 1000 grains in each pan . . . . .	10 10 0
One set of Grain Weights from 1000 to .01 of a grain in box . . . . .	2 0 0
One drying Oven in tinned iron, japanned, riveted together, with connections for gas inside, two doors and glass front . . . . .	4 10 0
One Dessicicator on stand . . . . .	0 16 0
One 1-ounce platinum Crucible and lid . . . . .	1 17 6
One pair crucible Tongs, platinum points . . . . .	1 2 6
Two mahogany Filter stands, single ring . . . . .	0 6 6
Two Bunsen burners, tripods and gauze . . . . .	0 12 0
Two tin filter Drainers . . . . .	0 1 8
Six test tubes and stand . . . . .	0 2 6
Six pipe clay Triangles . . . . .	0 3 0
Six Sheets glazed black paper . . . . .	0 1 0
Two hundred cut 4-inch filter papers, 1s. 3d. per 100 . . . . .	0 2 6
One wash bottle . . . . .	0 2 6
One 20-ounce measure divided into $\frac{1}{4}$ -ounce . . . . .	0 5 6
Three 20-ounce Beakers . . . . .	0 8 6
One 10-ounce Flask, graduated on neck . . . . .	0 2 6
Three 9-inch Stirring Rods . . . . .	0 0 6
Three 4½-inch Watch Glasses . . . . .	0 1 6
Two 20-ounce narrow mouth stoppered Bottles . . . . .	0 3 6
Three 3-inch Funnels . . . . .	0 1 3
Three 10-ounce Beakers . . . . .	0 2 8
Two 8-ounce narrow-mouthed stoppered Bottles . . . . .	0 2 0

Total exclusive of package . . . . .

£38 17 11

Packed and delivered to any town in England, or f.o.b. London, Liverpool, or Hull, 5 per cent. extra.

LABORATORIES FOR GAS AND GENERAL ANALYSIS FITTED COMPLETE WITH EVERY REQUISITE.



## INSTRUMENTS FOR ESTIMATING IMPURITIES IN COAL GAS.

### SULPHURETTED HYDROGEN.

Test Glass, on Stand. See Fig. 5 . . . . .	8 3 0
Test Papers. 12 each acetate of lead and turmeric at 2s. 6d. . . . .	0 5 0
Total . . . . .	<u>£3 8 0</u>

These are included in the Photometer Lists to meet the requirements of the Gas-Works Clauses Act.

Fig. 5.

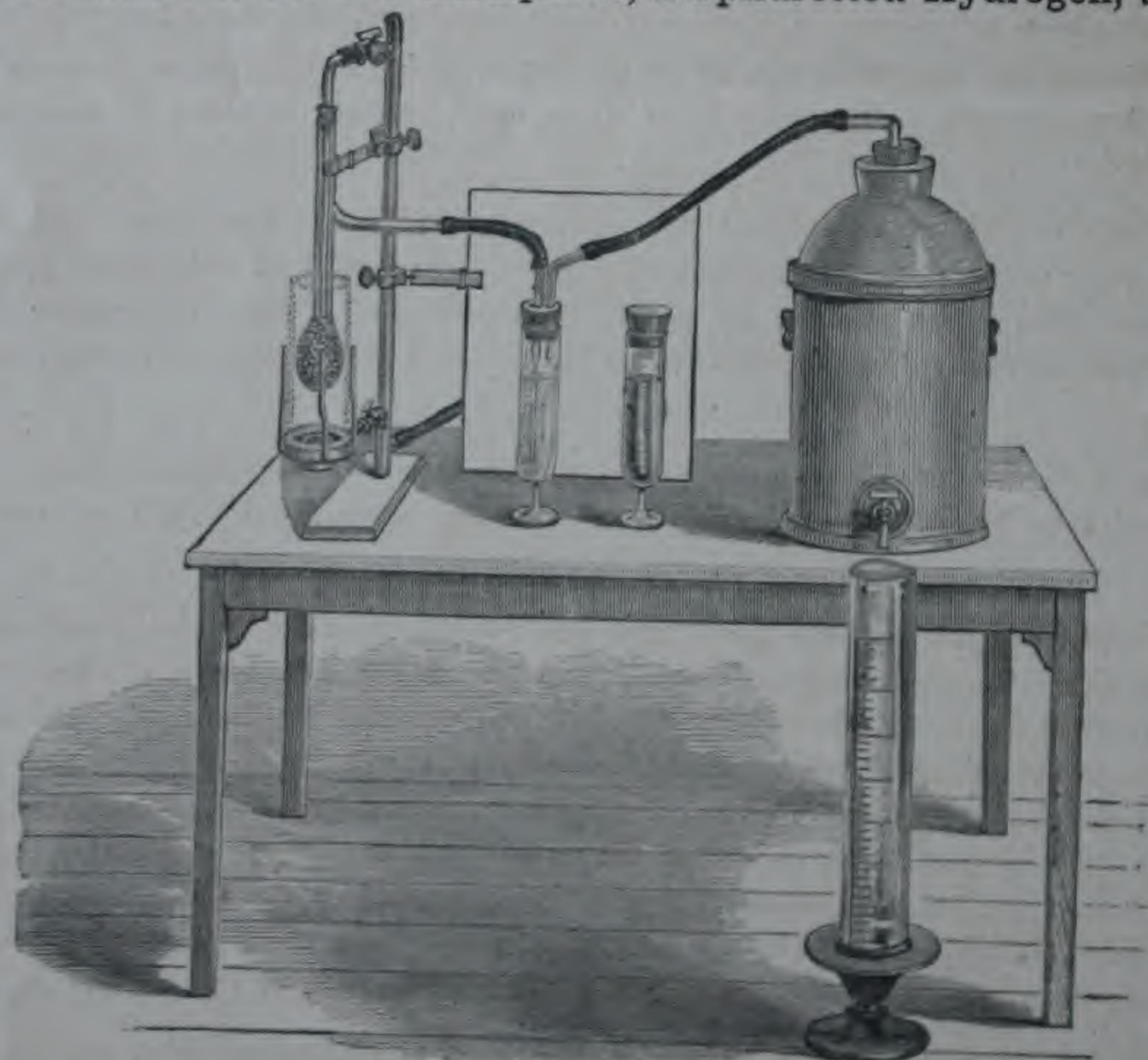
## AMMONIA TESTING APPARATUS.

The Gas in this test is measured, but the meter serves also for the Sulphur Test.

Ammonia Saturator. Glass vessel filled with glass beads and furnished with glass stop-cock. Mounted on stand, fig. . . . .	1 0 0
Two Mohr's Burettes, divided into 100 septems, and sub-divided in 1-5ths, with Eardman's floats, and with funnels and pinch-cocks. With stand . . . . .	1 7 0
Half Gallon each of Solution of Sulphuric Acid, 25 septems of which neutralize one grain of Ammonia, and of Ammonia Solution containing one grain of Ammonia in 100 septems . . . . .	1 1 0
Hæmatine (Tincture of Logwood), 4 oz. in stoppered bottle with pipette . . . . .	0 4 6
Two Pint Stoppered Bottles to contain solutions in use . . . . .	0 3 0
Sundries.—One each 100 and 50 septem pipettes; two half-pint beakers; testing beaker or flask; one 20 oz. and one 10 oz. graduated measure and glass stirrer . . . . .	0 9 6
Total . . . . .	<u>£4 5 0</u>

## HARCOURT'S COLOUR TESTS.

For the rapid estimation of Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid.

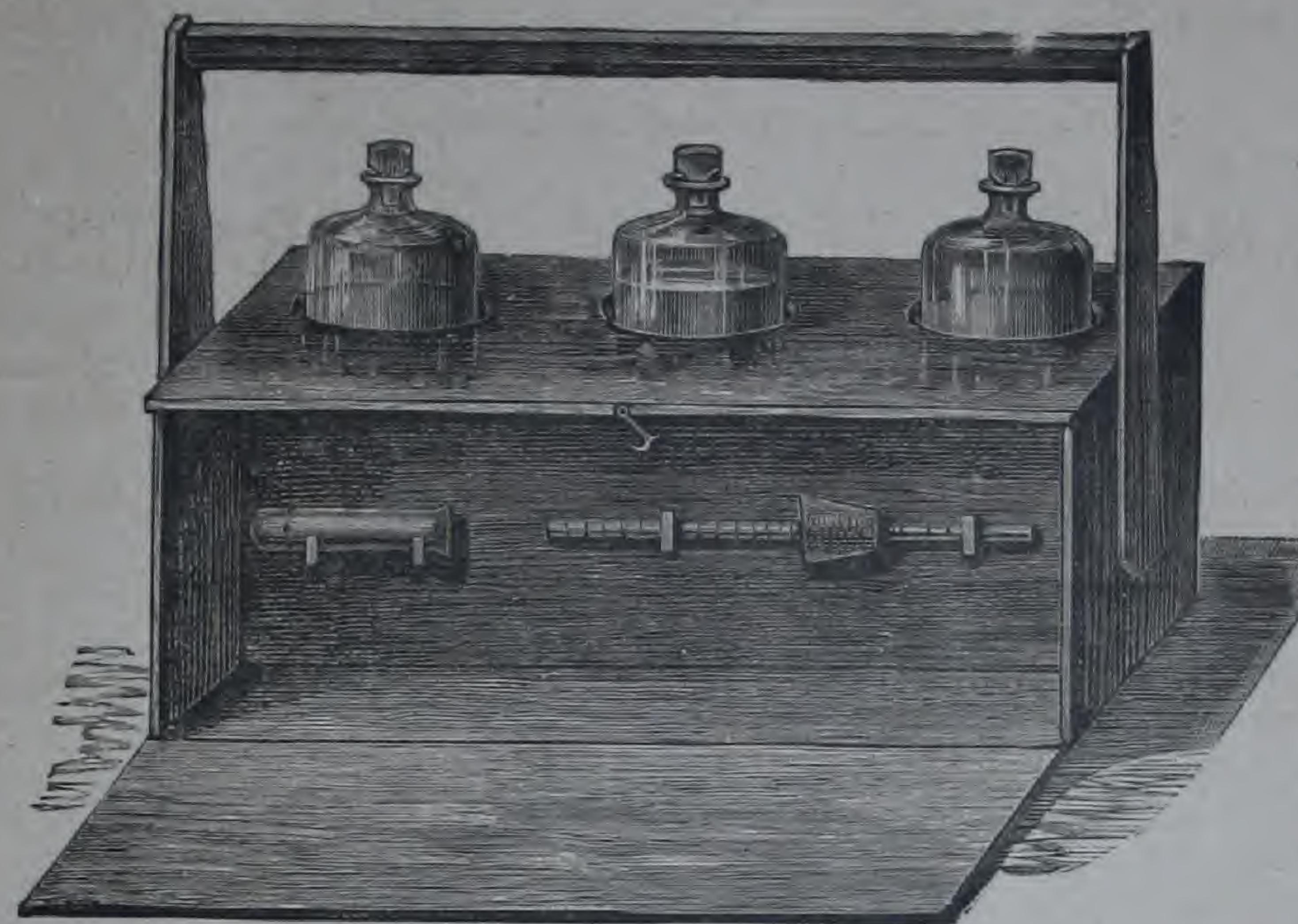


Apparatus complete, with colour standards and solution . . . . .

This is a most valuable apparatus for the gas-maker, as by its aid he may expeditiously estimate the amount of the impurities above mentioned, and thereby satisfy himself as to the efficiency of his purifying processes. The tests are for carbonic acid, sulphuretted hydrogen, and bisulphide of carbon. The processes consist in aspirating, or drawing by very simple contrivances, the gas through a large test-tube, charged with the necessary substance in solution, and continuing the action until the solution in the test-tube assumes the same opacity or colour as the liquid in another sealed tube, which serves as a standard. The quantity of water which is drawn from the aspirator into a suitably graduated measure represents the quantity of gas operated upon; and, in order to know the amount of the impurity contained in 100 cubic feet of gas, no more is needed than to turn to tables which Mr. Harcourt has formulated, and opposite the figure corresponding with the measured quantity of water is found the figure desired. For sulphuretted hydrogen and carbonic acid tests, the gas is drawn direct from a service through the test-tubes; but, in bisulphide testing, that compound must be decomposed into sulphuretted hydrogen. This is effected by passing the gas first through a heated glass bulb containing platinized pumice.

£5 10 0

# FOLKARD'S APPARATUS FOR TESTING SCRUBBED GAS, SPENT LIME AND LIQUOR, SULPHURETTED HYDROGEN, AND CARBONIC ACID.



JAMES V. QUEEN & CO.,  
SOLE AGENTS,  
IN NORTH AMERICA,  
(DEPARTMENT No. 4)

In introducing this small apparatus to the gas world we feel that its simplicity, facility of manipulation, and its cheapness will strongly commend it to all gas engineers who desire a quick and easy means of testing for sulphuretted hydrogen, &c., at the purifying house. It is strongly made, and can be confidently left in the hands of any intelligent workman to manipulate without fear of damage, who, with but little practice, can take testings of a set of six or eight purifiers in about 30 minutes and a daily record of the work done by each purifier obtained.

This apparatus serves to determine 0·1 to 2 per cent. of sulphuretted hydrogen (in scrubbed gas), which in the latter case is somewhat difficult with the Harcourt's Colour Test. It consists of a glass tube about  $\frac{3}{4}$ -inch diameter, permanently closed at one end, and has a capacity of 60 septems. This serves to hold the gas to be tested; and is filled by displacement by holding it (open end downwards) over a lamp-cock, furnished with a piece of india-rubber tube 3 or 4 inches long, to conduct the gas to the top end of the "gas tube."

The smaller or solution tube is divided into 20 septems, and provided with a sliding stopper which can be adjusted for varying quantities of iodine solution from 1 to 20 septems—each septem of solution being equal to 0·1 per cent. of sulphuretted hydrogen in the sample of gas tested.

To make a test proceed as follows:—Place the test glass, open end downwards, over the lamp-cock, and while it is filling adjust the sliding stop in the "solution tube" to the number of septems relative to the percentage of sulphuretted hydrogen you suspect to be present, and fill to the top with solution, and while holding the test glass in one hand over the cock insert the solution tube up to the stopper, and holding the stopper firmly in place briskly shake up the solution with the sample of gas thus enclosed. Provided enough iodine solution to have been taken, all the sulphuretted hydrogen should be destroyed. To ascertain this a small slip of acetate of lead paper is inserted into the tube by partially withdrawing the stopper. If the paper be blackened, a second adjustment of this is made, and more iodine solution is put into the solution tube, a fresh sample of gas taken, and the test repeated. If the lead paper is not discoloured, less iodine solution is taken and a fresh trial made; and so on until a sufficiently close approximation is obtained. As previously explained, the percentage of sulphuretted hydrogen is obtained by the amount of iodine solution required.

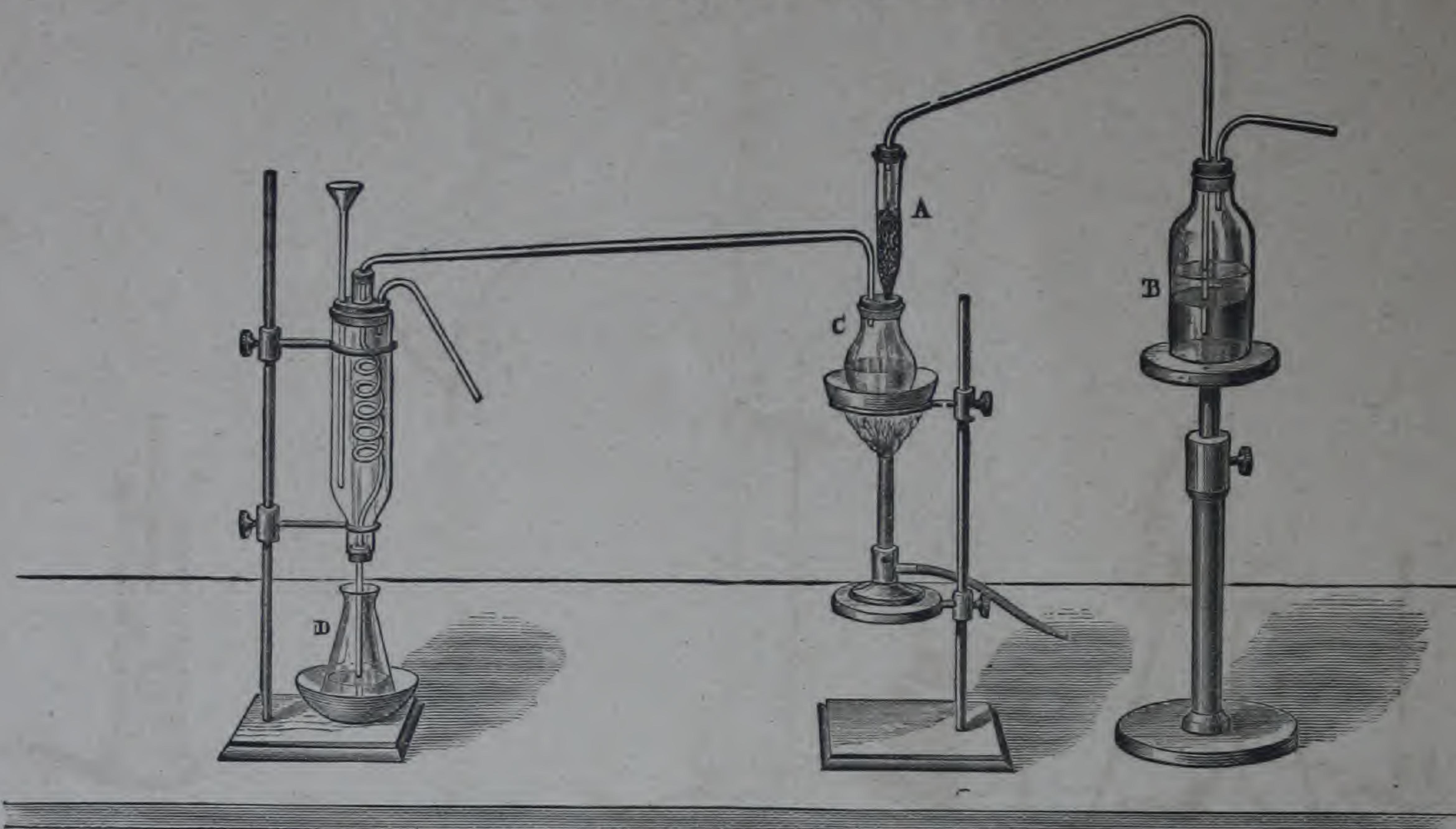
Say, for example, that first you take 10 septems of iodine solution and find upon applying the lead paper is not discoloured; and second, having taken 9 septems of solution there is a very slight discolouration of the paper, then you know that there is about 9 per cent. of sulphuretted hydrogen.

The Iodine Solution sent out is a "Stock Solution," and should be diluted with water in the proportion of one part of iodine solution to five parts of water.

Apparatus complete, together with one bottle of Stock Solution, one pint bottle for Solution in use, one pint bottle for water, and supply of Acetate of Lead Papers, fitted in strong walnut case, with drawer to hold the glass tubes and test papers:

Price . . . . . £1 10 0

## APPARATUS FOR ASCERTAINING THE PERCENTAGE OF SULPHUR IN SPENT OXIDE.



**Apparatus**, consisting of 4-oz. evaporating flask fitted with funnel, eduction pipe, glass condenser, collecting flask, sand bath, tripod and wood stands, and Bunsen burner  
**Bisulphide of Carbon**, per pound, in stoppered bottle. (See note, p. 17)

1	8	0
0	4	0

## Apparatus for Young's Method of Rapidly Estimating Sulphur in Coal Gas.

See *Gas Analysts' Manual*.

Two Burettes, divided into 1-5ths of a septum, on stand complete, one half decigallon flask, one 25 septum pipette, one small pipette, three beakers, one glass rod and wash bottle	1 17 6
Flat Platinum Crucible, about	1 15 0
Rose-Head Bunsen Burner	0 2 6
Solution Barium Chloride, containing 1,625 grains—in the gallon—per Win. qt.	0 8 0
Solution Silver Nitrate, containing 531·2 grains—in the gallon—per	0 10 6
Yellow Chromate of Potassium, per pound	0 3 6

## INSTRUMENTS FOR PRACTICAL ANALYSIS, &c.,

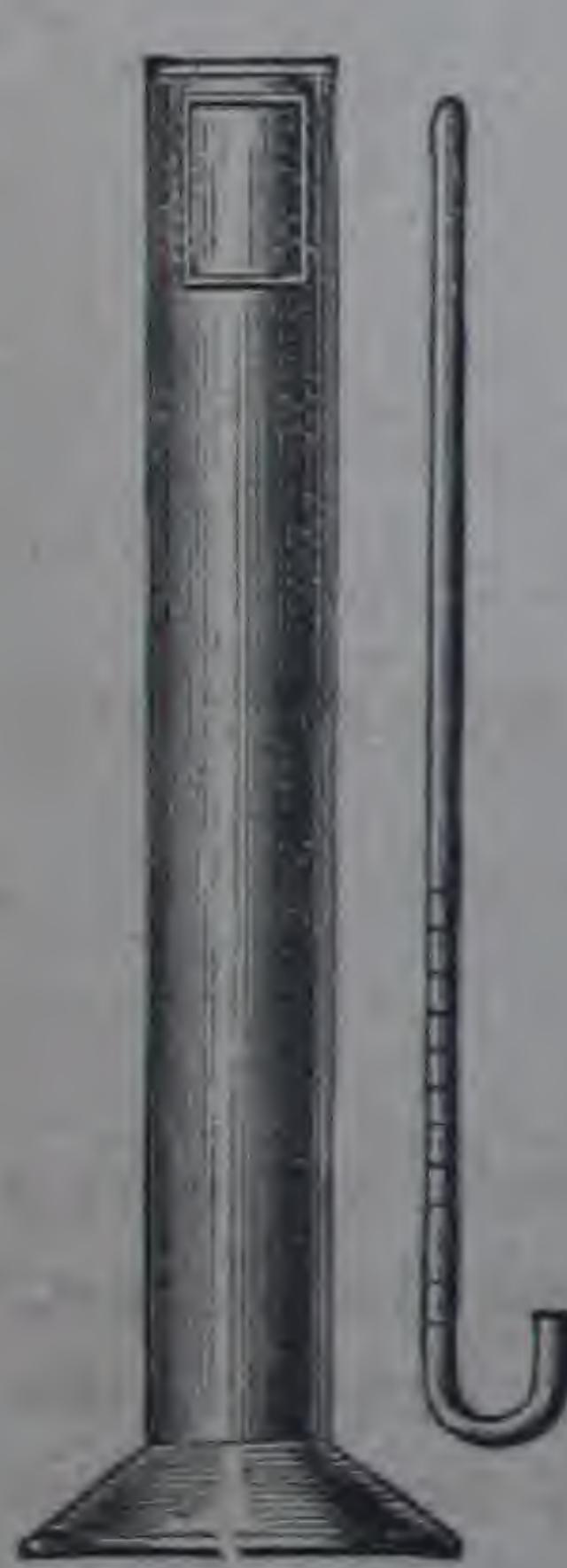


Fig. 75.

**Eudiometer Apparatus** (Thompson's Form), consisting of graduated glass tube; water cylinder for the immersion of the tube in order to equalize its temperature; water dish or pan for dipping the mouth of the tube before unsealing; flexible tube with glass mount, for filling tube with gas; and pipette, for delivering reagents, fig. 75

1 12 6

**Eudiometer Apparatus**, consisting of graduated glass tube, about 12 inches in length, with bulb top. Glass water cylinder, water dish, flexible tube, with glass mount and pipette

1 12 6

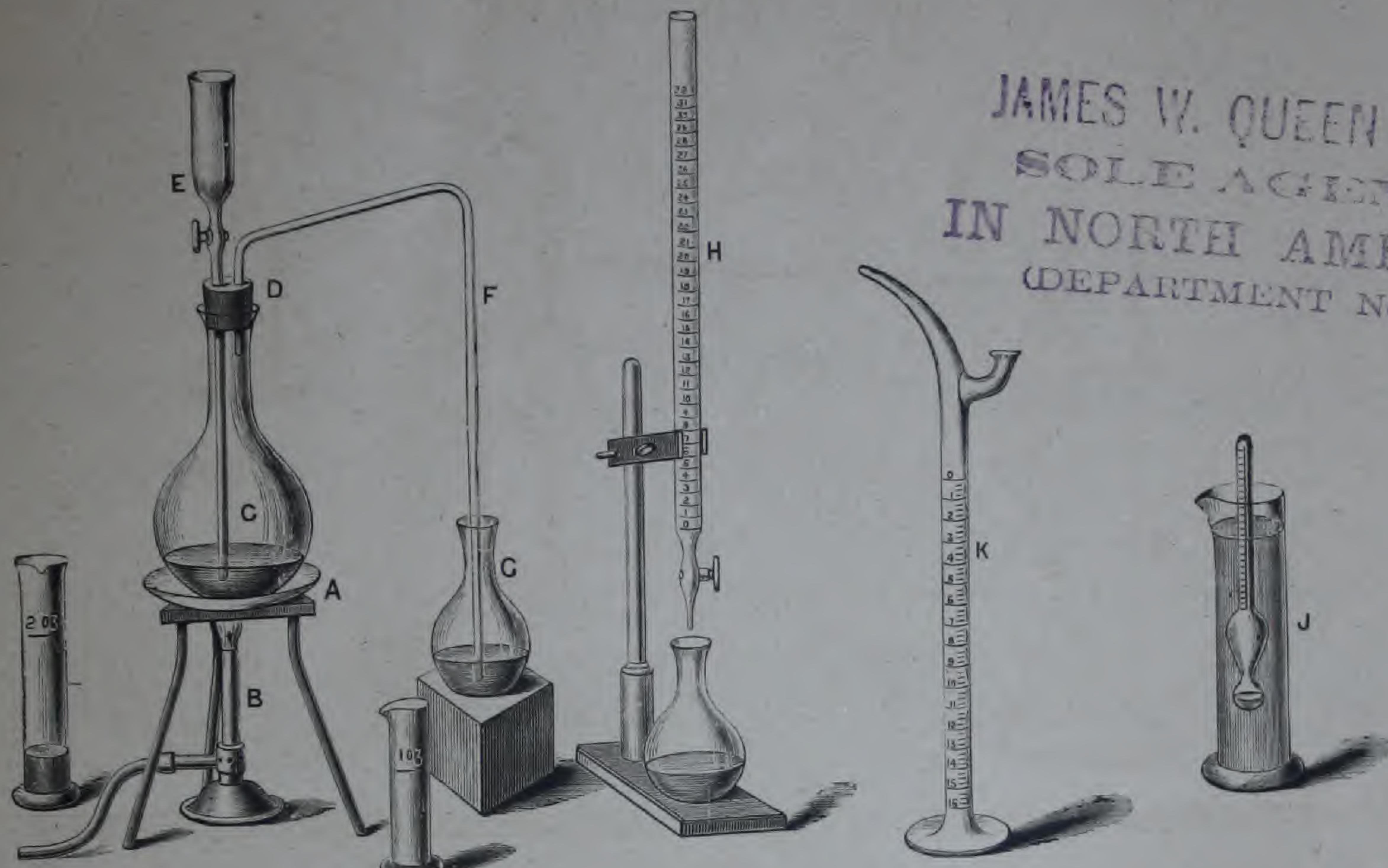
*Chemicals for use with the above.*

Pure Potash, per 4-oz. bottle	0 2 0
“ Acetate of Lead, 4 ozs.	0 1 6
“ Bromine, per 1 oz. bottle (Note, p. 15)	0 2 6
“ Subchloride of Copper, per 4-oz. bottle	0 5 0
“ Pure Sulphate of Copper, 4 ozs.	0 1 6

**Eudiometer Apparatus**, comprising the instruments specified under No. 76, with supply of chemicals and with bromine bottle in screwed wood case; the whole fitted in a lined deal case, with lock and handle.

3 0 0

## INSTRUMENTS, &amp;c., FOR TESTING AMMONIACAL LIQUOR.



JAMES V. QUEEN & CO.,  
SOLE AGENTS,  
IN NORTH AMERICA,  
(DEPARTMENT No. 4)

Twaddel's Hydrometer for showing the strength of liquor by specific gravity, including Glass Jar—Fig J in the engraving  
Alkalimeter, K in the engraving, divided into 16 parts, each subdivided ; stirrer, one quart of test-acid, 6 test books, and a  
basin for mixing acid and liquor

0 5 0

0 12 6

Set of Apparatus for testing liquor by the Wills' Method of distillation, consisting of a Sand Bath, A (see engraving),  
a Bunsen Burner, P ; Flask, C, with stopper, D ; Funnel, E ; Tube F ; Flask, G ; Burette and Stand, H ;  
and Two Measures of 1 oz. and 2 oz. capacity

2 5 0

1 0 0

0 7 6

Half-a-Gallon Mixing Jar for making solutions—stoppered

Thermometer for taking the temperature of solutions

Delicate Hydrometer, indicating gravities up to about 1100 ; for approximatively determining the strength of the acid  
solution—with glass jar

0 10 6

Eight-ounce graduated glass measure

0 3 6

## PREPARED TEST SOLUTIONS.

Sulphuric Acid, Sp. Gr. 1064·4—per gallon in two stoppered bottles

0 10 6

Ammonia—of equivalent strength to the acid solution—per gallon in two stoppered bottles

0 10 6

Caustic Soda, strong for dilution with water, half-gallon in bottle

0 10 6

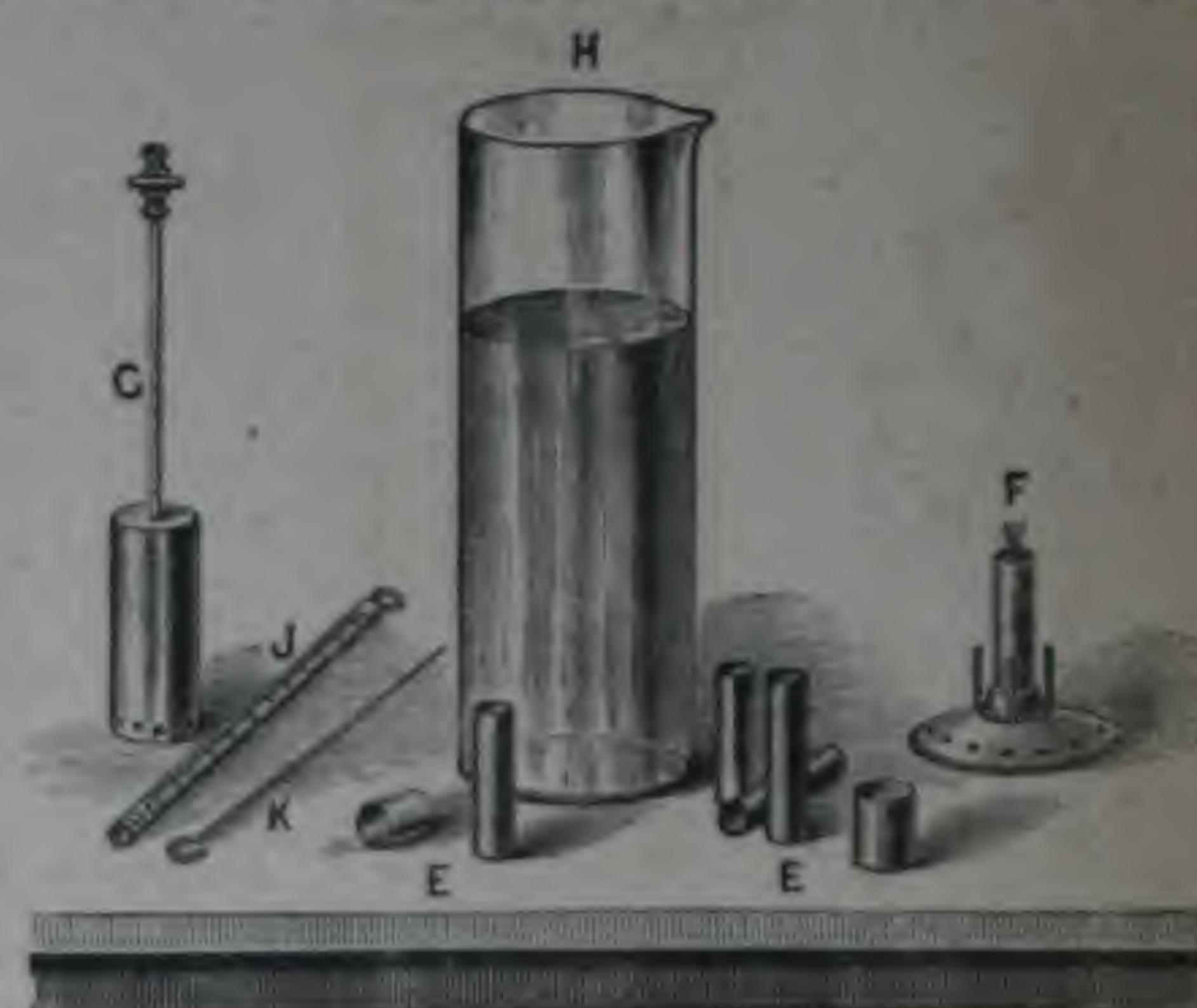
## AMMONIA LIQUOR TESTS, &amp;c.

By F. W. HARTLEY, 1s. 1d. p.p.

This little work contains instructions for making the various tests, preparing test solutions, and for ascertaining  
the percentage of Sulphur in spent Oxide.

NOTE.—Corrosive Chemicals cannot generally be packed with apparatus. They must be "declared" when delivered  
to the Carriers, and should be in separate cases. Strong Volatile Alkalies and Acids should be contained in strong  
bottles, be packed separately, standing upright in strong wooden cases, with wooden divisions between the bottles, the  
spaces being filled up with straw. Such Chemicals will be carefully packed by A. Wright & Co., but sent only at the  
purchaser's risk.

## APPARATUS FOR ASCERTAINING THE HEATING POWER OF FUEL.

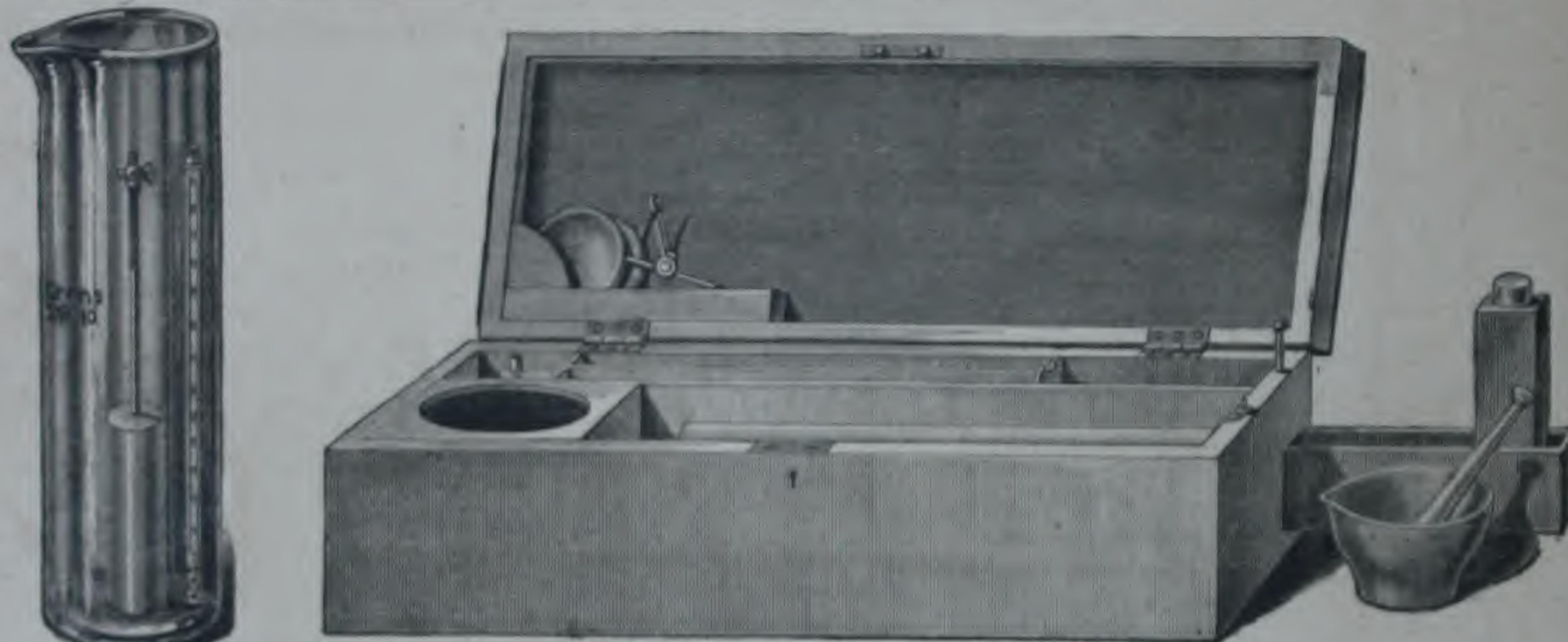


CALORIMETER IN ACTION.

**Thompson's Calorimeter**, consisting of combustion cylinder, with separate spring-clutch, base, 6 cylindrical copper furnaces, 2 short ditto, glass water cylinder, thermometer, scales and grain or gramme weights, iron pestle and mortar, sieve, canister filled with oxygen mixture, &c. With instructions for use; in French polished, cloth lined, mahogany case, with drawer, lock and key, adapted for either the English or metric systems as required . . . . .

6	0	0
5	0	0

Ditto in varnished deal box, with lock and handle . . . . .



This is the most convenient apparatus extant by which to ascertain the relative values of fuels. It has been adopted by several Railway Companies as the standard by which to determine the commercial value of the coals which they buy. It is also used by other large purchasers of fuel. Is employed in the Naval Departments of the British and of some Foreign Governments, and is used in the most important colleges and schools of chemistry, by analytical chemists, by coal owners, coal factors, &c.

The indications may be readily converted into, and expressed by, the equivalent number of any recognized thermal unit, as explained in the instructions which accompany the apparatus.

## SPECIFIC GRAVITY.

**Schilling's Apparatus**, fig. 91, consisting of cylindrical glass water vessel, glass immersion cylinder, fitted with metal base and top, the latter furnished with cock to admit gas, and also with a central cock having two ways, one for the admission into, or the rapid discharge of air from, the immersion cylinder, and the other for discharging air or gas very slowly when making experiments. Price inclusive of a Sensitive Thermometer . . . . .

4 4 0

By this instrument the specific gravity of gas is determined by the times required for the discharge of equal volumes of air and of gas through a minute orifice in a platinum plate, mounted in the nozzle of the central cock. The square of the number of seconds required for the discharge of the gas, divided by the square of the number of seconds required for the discharge of the air, giving the specific gravity of the gas; no correction being needful, if the temperature of the air and of the gas be the same.

**Glass Specific Gravity Flasks**, mounted with stop-cocks. Of any description to order.

These flasks are employed where exactness is required. They are generally of 50 to 200 cubic inches each in capacity, can only be used when a very delicate balance is available, and demand considerable skill and great care in manipulation.

**Dr. Letheby's Specific Gravity Globe**, fig. 93, with two stop-cocks, thermometer, glass tube, and gas jet. The weight of the globe, when empty and when full of air at 60° Fahr. and 30 inches Bar., engraved upon it . . . . .

2 10 0



Fig. 91.



Fig. 93.

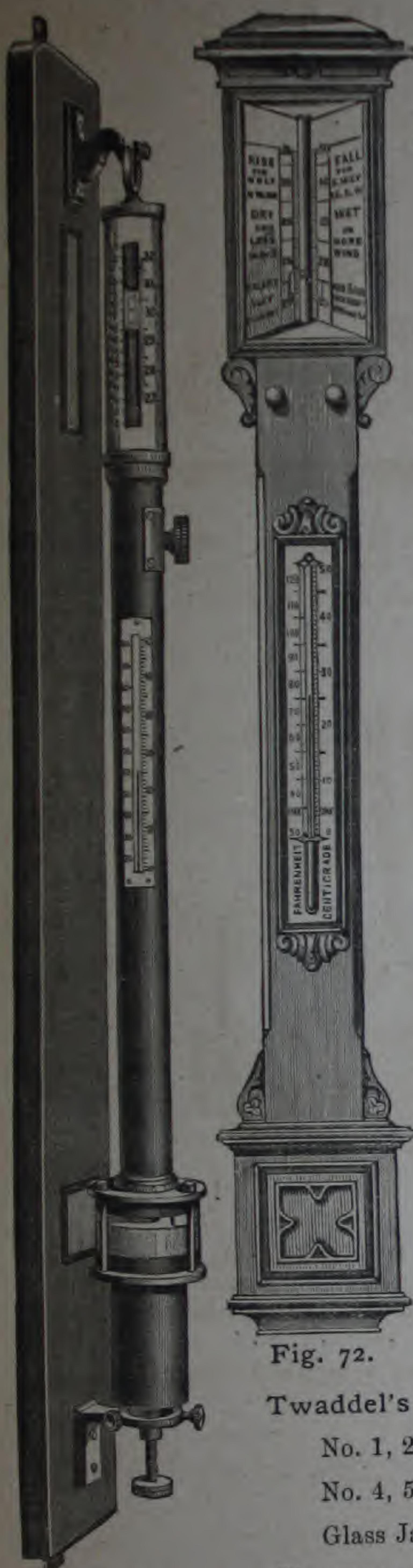


Fig. 69.

## BAROMETERS.

**Barometer, Standard**, of the best construction,  $\frac{3}{4}$ -inch internal diameter, scales with Verniers graduated to show to 1-500th of an inch, and 1-10th of a French millimetre, with delicate thermometer fitted on to a brass casing. The whole exquisitely finished and mounted on suspension board, furnished with enamelled glass reflectors at points of observation, fig. 69 . . . . . 21 0 0

**Barometer, Standard**, similar to above, tube  $\frac{1}{2}$ -inch internal diameter, with suspension board . . . . . 12 0 0

**Barometer, Standard**, similar to the last, but not so highly finished, tube  $\frac{1}{3}$ -inch internal diameter, without reflectors . . . . . 7 10 0

**Barometer**, plainly finished, Vernier indicating to 1-100th of an inch. On oak suspension board . . . . . 5 15 0

**Barometer, Pediment**, mounted in solid oak, mahogany, walnut, or rosewood frame, tube 4-10ths inch internal diameter; two ivory scales, with or without the Fitzroy inscriptions; two Verniers to give readings to the 1-100th of an inch; delicate thermometer on frame, upper part of tube, scale and thermometer protected by frames fitted with bevelled-edge plate glass, fig. 72 . . . . . 5 10 0

**Barometer, Pediment**, same quality as the last, but with one scale and Vernier . . . . . 4 4 0

**Barometer, Pediment**, smaller tube, and with commoner frame, thermometer, &c. . . . . 2 10 0

**Aneroid Barometer**, brass case, in velvet lined box, 8 inch . . . . . 1 0 0

**Aneroid Barometer**, pocket size,  $2\frac{1}{2}$  inch, brass case, silvered metal dial, altitude scale 8,000 feet, fig. 73 . . . . . 1 15 0

Standard Barometers prepared for Kew Verification.

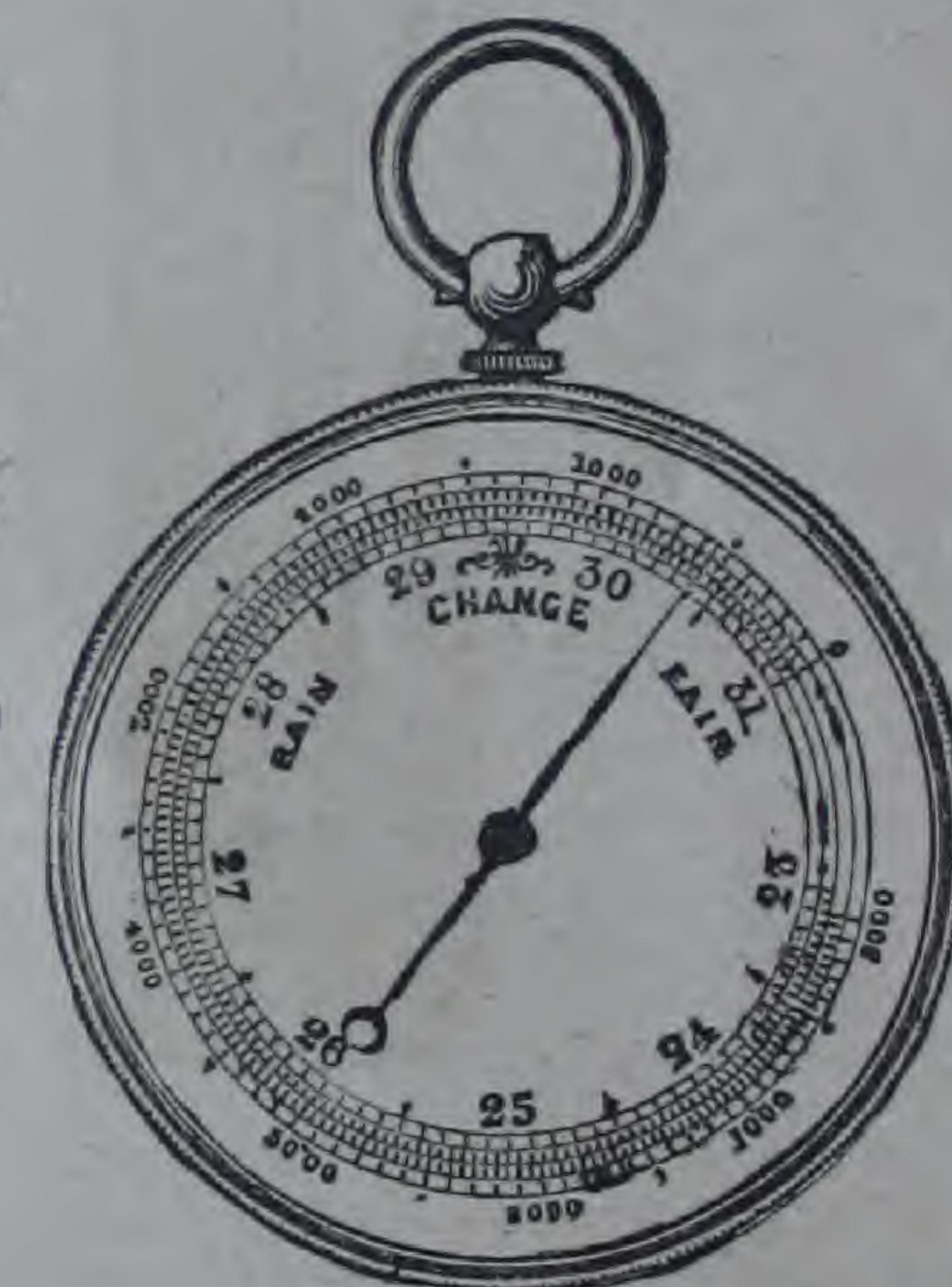


Fig. 73.

## HYDROMETERS.

## Twaddel's Hydrometers—

No. 1, 2, or 3, ivory scale, in tin case . . . . . each 2 6

No. 4, 5, or 6, " " " . . . . . " 3 6

Glass Jars for the above . . . . . 2 6

The range of the above, 1 to 6, is equal to 1.000° to 1.850° specific gravity.

Fig. 72.

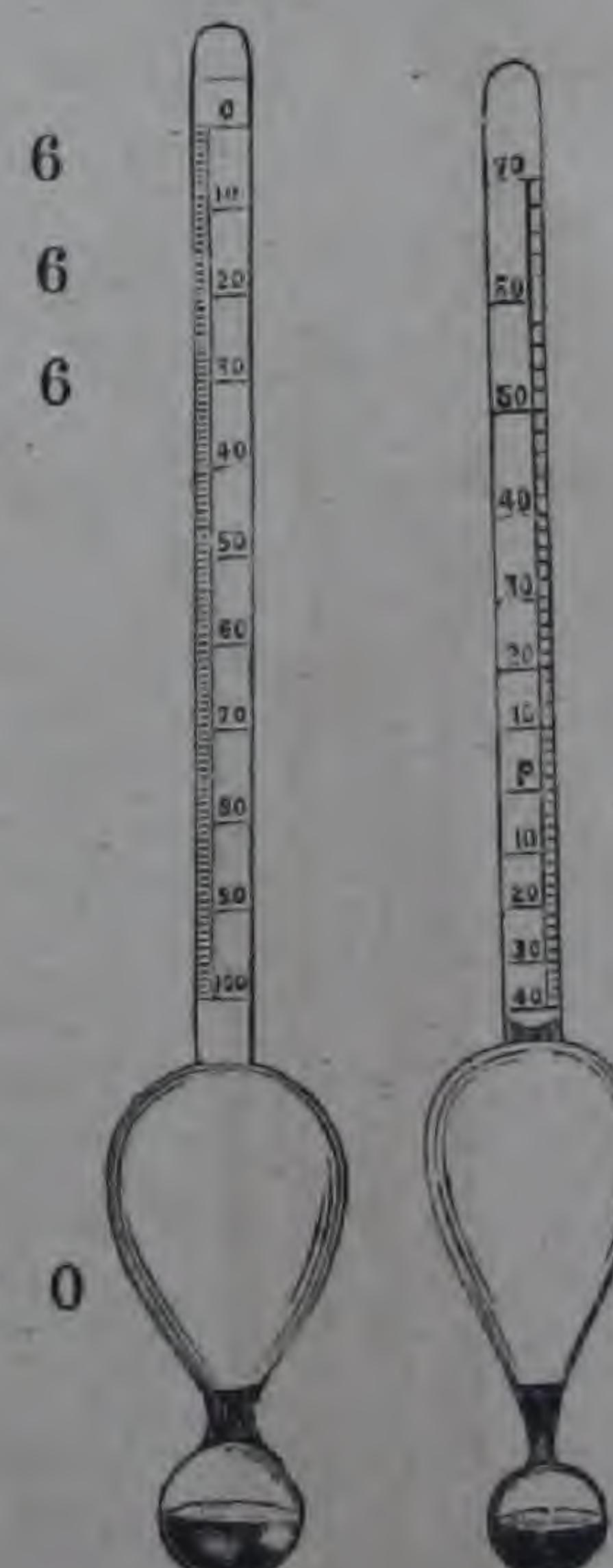
	Twaddel's Scale.	Specific Gravity.
No. 1 . . .	0°—24° ..	1.000 to 1.120
No. 2 . . .	24°—48° ..	1.120 , 1.240
No. 3 . . .	48°—74° ..	1.240 , 1.370

	Twaddel's Scale.	Specific Gravity.
No. 4 . . .	74°—102° ..	1.370 to 1.510
No. 5 . . .	102°—138° ..	1.510 , 1.690
No. 6 . . .	138°—170° ..	1.690 , 1.850

To convert any degree of Twaddel to specific gravity multiply by 5 and add 1000.

Set of 6 Twaddel Hydrometers, ivory scales, with thermometer, divided on stem, in mahogany case . . . £2 2 0

Hydrometers fitted with paper scales, 15 per cent. less.

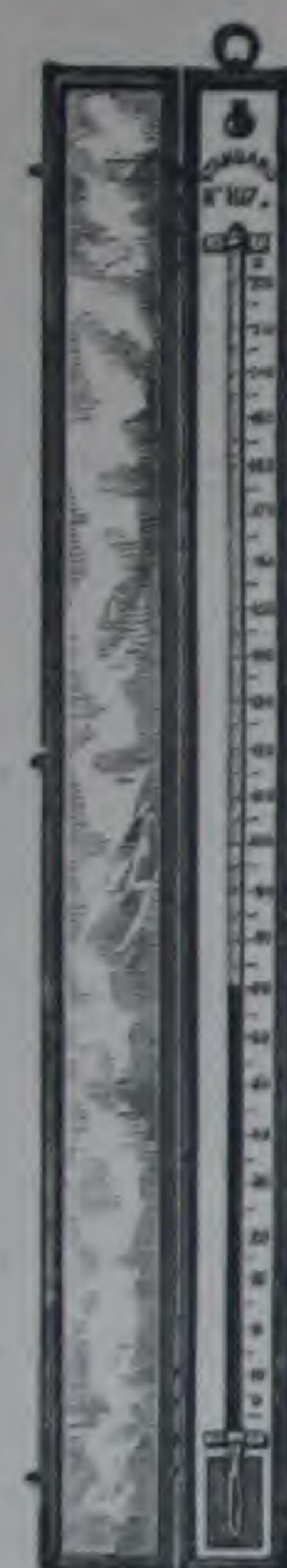


Barometers, Hydrometers, &c., repaired and adjusted to the Government Standard.

55, 55a, and 56, Millbank Street, Westminster, S.W.

## APPARATI

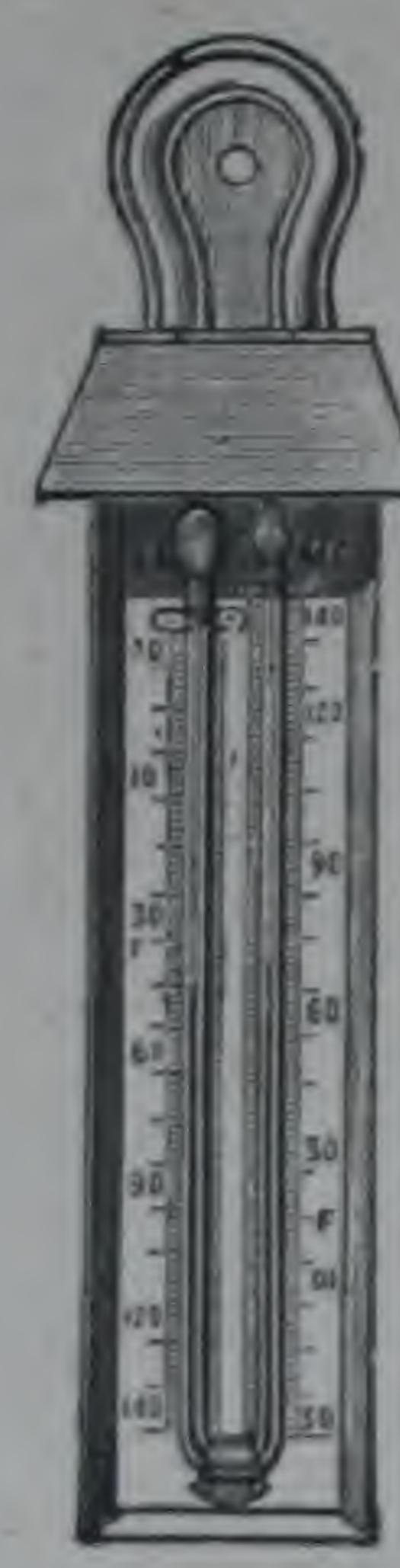
## THERMOMETERS.



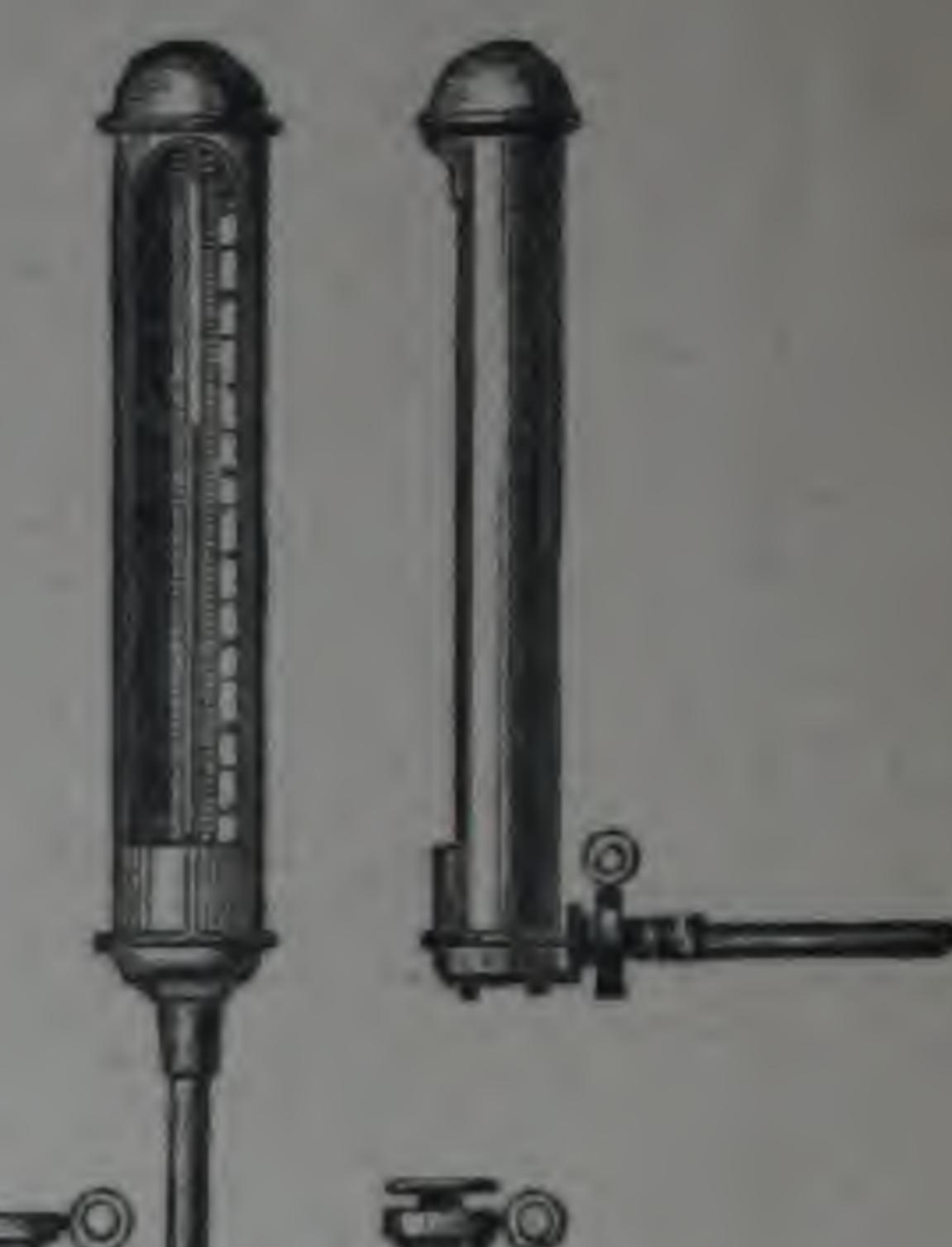
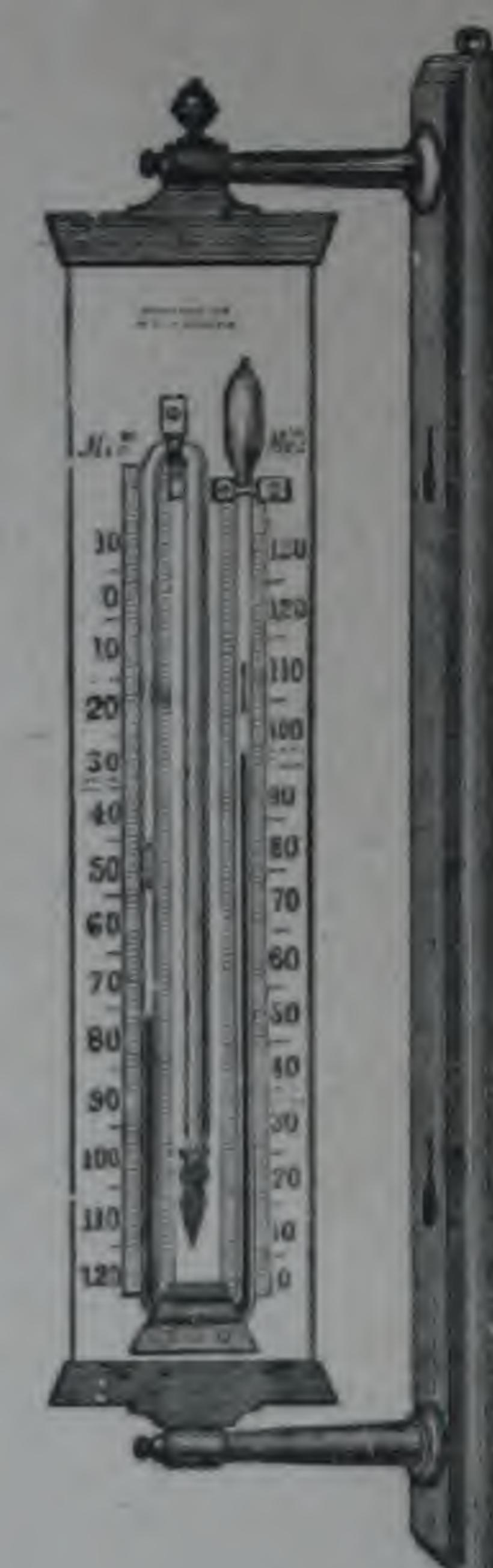
No. 1.



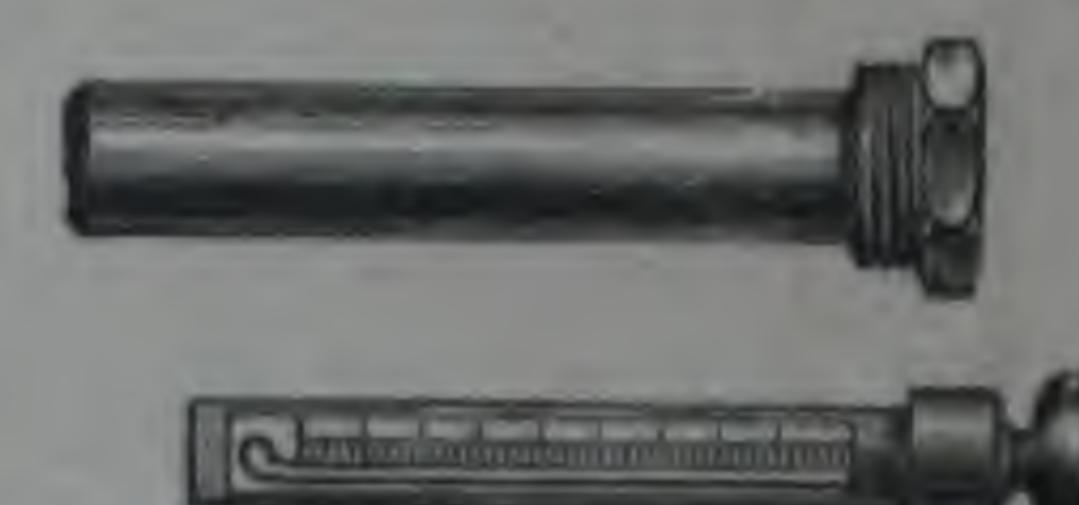
No. 2.



No. 3.

Mason's.  
No. 6.

No. 19 T, Thermometers.



No. 21 T.

Highly Sensitive Chemical Thermometer, calibrated to the fifth of a degree, mounted in brass tubular case, divided and figured on glass stem, fig. 2 . . . . .	0 12 6
Delicate Thermometer for use with experimental and test meter, calibrated on stem; open scale ranging from 30°—95° . . . . .	0 5 0
Do. do. mounted in brass socket with plug. . . . .	0 7 6
Standard Thermometer, enamelled tube, scale engine divided on stem and figured on silvered metal raised plate 0°—220°, enclosed in a hinged morocco case—verified at Kew; copy of index error furnished with the instrument, fig. 1 . . . . .	1 15 0
Mason's Standard Hygrometer, indelible opal or porcelain scales, enamel tubes, engine divided on stem, mounted on oak or mahogany board, best, fig. 6 . . . . .	1 10 0
Six's Self-Registering Maximum and Minimum Thermometer, opal (transparent glass) scale, enamel tube in white japan case, and magnet, 10-inch . . . . .	0 18 0
Six's Self-Registering Maximum and Minimum Thermometer, opal scale, plain or enamel tube on oak board, with brackets to revolve, complete, fig. 14", £1 2s.; 12", £1; 10", 16s. 6d. each.	
Porcelain (hung up) Thermometer, extra bold, enamel tube, engine divided, hand painted, Fahrenheit and Centigrade scales, very legible, 20", 17s. 6d.; 10", 5s. 6d.; 8", 4s. 6d.; 12", 8s.; 14", 10s., fig. 8.	
Main Thermometers, for insertion in gas mains.	

## THERMOMETERS,

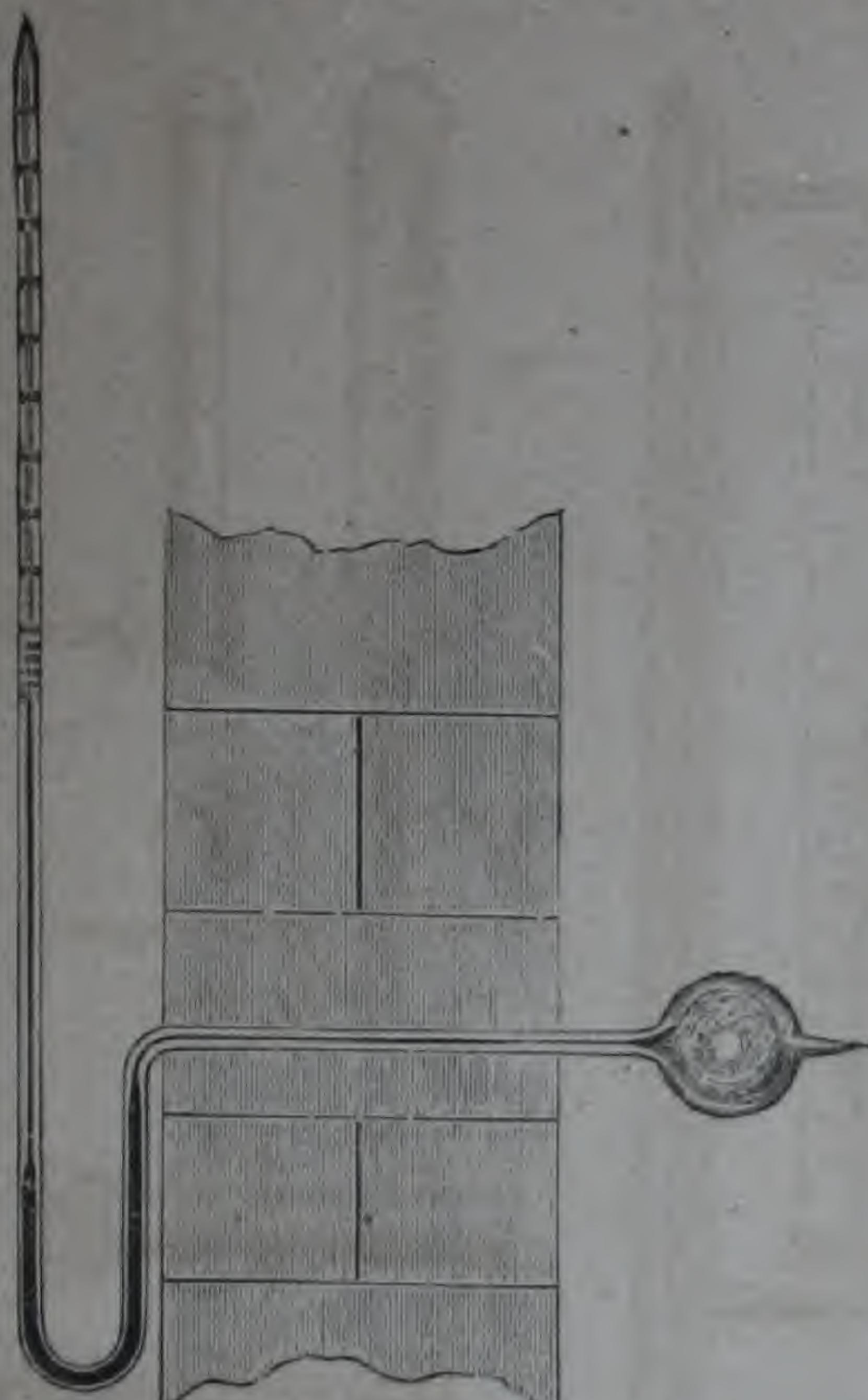
For inserting in pipes or vessels, such as the condensers of Gas-Works, to show the temperature of gas or other fluids which pass through.

No. 19 T.—Thermometer, in brass case, with plug end ground to fit a metal socket having an external screw. Price with socket. . . . .	1 2 6
No. 19 T.—Thermometer, as above, but with plug at right angles to case. Price with socket. . . . .	1 5 0
No. 20 T.—Sockets and Plugs . . . . .	each 0 2 6
No. 21 T.—Thermometers with cylindrical iron cases . . . . .	Price 0 10 6

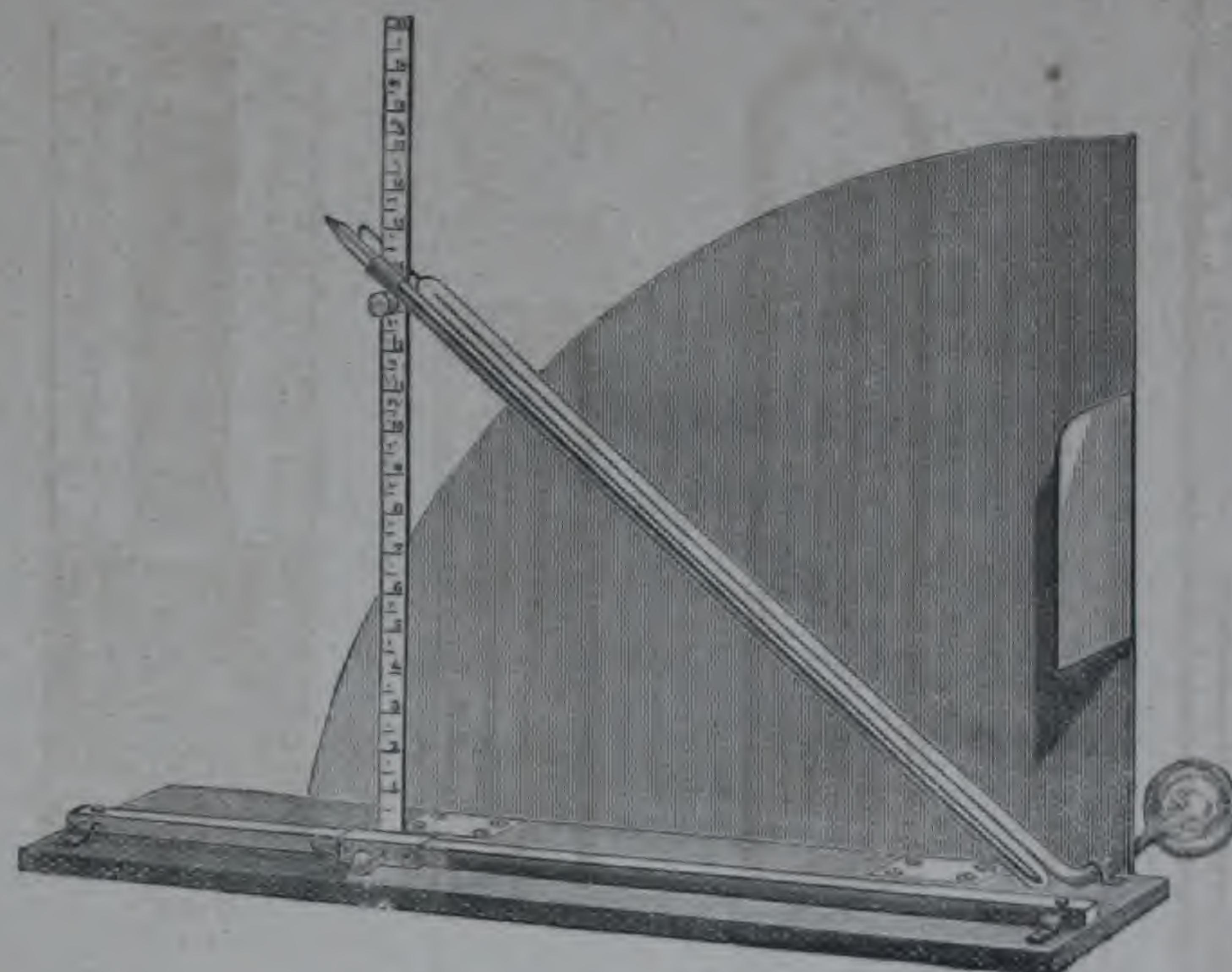
THERMOMETERS OF EVERY DESCRIPTION.

## THERMOMETERS FOR EXTREME TEMPERATURES

(UP TO A WHITE HEAT).



H. & F.'s TECHNICAL THERMOMETER.



FOLKARD'S STANDARD THERMOMETER.

### HEISCH & FOLKARD'S MODIFICATION.

These Instruments are specially adapted for Tar Stills, Digesters, Bakers' Ovens, Boiler Flues, Superheaters, Hot Blast Apparatus, Retorts for the Distillation of Wood, Shale, Coal, &c., and, in fact, for all purposes where the temperatures are beyond the range of the ordinary mercurial thermometer, and where an expensive pyrometer has been the only available instrument up to the present time.

It is now being generally recognized that a fair approach to exact temperatures in carrying on manufacturing operations is necessary to secure the highest yield and the finest quality of the product; and consequently the thermometer has become an instrument of everyday use in chemical works of all kinds, breweries, gas-works, &c., &c., and a simple and reliable means of indicating temperatures *above* the boiling point of mercury has long been a desideratum.

It is believed that the present instrument fulfils all requirements. The reading is taken in exactly the same way as with an ordinary thermometer, the temperature being indicated by the pressure of the air enclosed in the bulb, which is exposed to the source of heat, acting on a vertical column of mercury, as shown in the woodcut, which represents a thermometer built in a wall. By employing a platinum or porcelain bulb the very highest temperatures can be indicated.

One of the great advantages of the instrument is that the temperatures are seen at a glance without the time and manipulation required in using the Siemens' or other pyrometer. The instrument is, of course, unaffected by changes in the height of the barometer, being hermetically sealed.



### FOLKARD'S STANDARD THERMOMETER, FOR CHEMICAL AND PHYSICAL LABORATORIES.

*(Awarded Silver Medal at the Inventions Exhibition, 1885.)*

This is a convenient form of the simple air thermometer used in physical researches. By an easy adjustment, somewhat similar to that of Fortin's Barometer, the pressure of the gas enclosed in a bulb exposed to the source of heat is measured in inches or millimètres on a divided scale. From the pressure thus measured the temperature can be at once deduced, either graphically on millimetre paper or by calculation.

The range of the instrument is from the lowest attainable temperatures up to the softening point of the bulb, which may be of platinum or porcelain. The instrument is hermetically sealed and consequently unaffected by barometric variations.

The pressure of the gas enclosed in the bulb is balanced by a column of mercury contained in a tube, the inclination of which can be varied. The resultant pressures are proportional to the sines of the angles of inclination of the mercurial column to the horizon, after allowing for capillarity; but, as stated above, these pressures are in practice read off on the graduated brass scale.

The woodcut represents an instrument with 20 inch scale for gases and vapours. A modified form is made for use with liquids.

# CLOCKS.

**Eight-Day Regulator Clock**, of first-class workmanship, in oak or ebonized cases, bevelled glass panels, centre seconds dead beat escapement, standard compensated pendulum, silvered dial, striking every minute . . . . .  
This clock can be highly recommended as a first-class instrument of reference for use in gas or other large works where correct time is an important consideration.

25 0 0

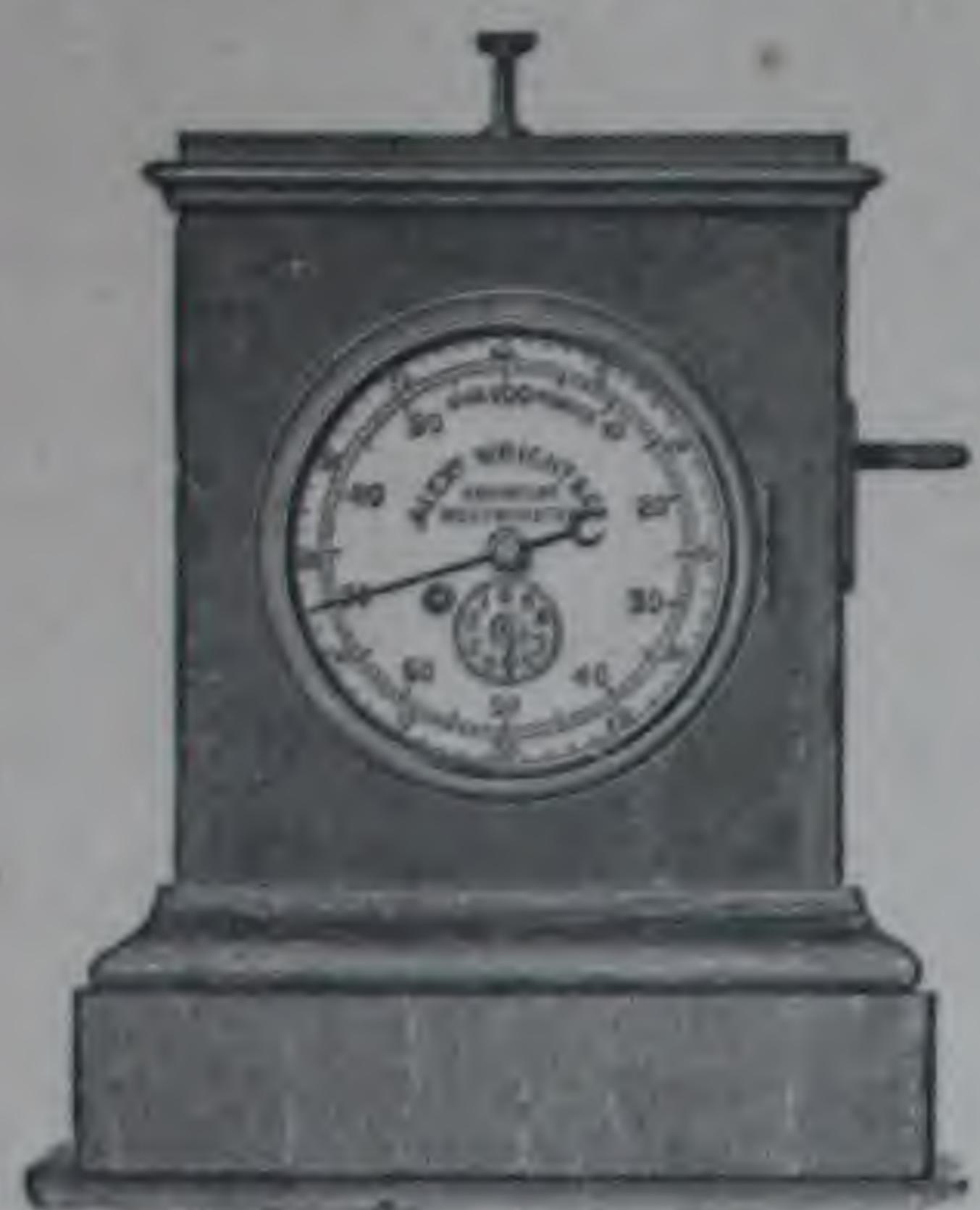


Fig. 4.

**Eight-Day Experimental Clock**, with standard pendulum, wood rod and zinc bob, dead beat escapement, centre seconds, enamelled dial, polished mahogany or ebonized case, with handsome moulded front, best lacquered bezel, glazed with bevelled crystal . . . . .  
Twenty of these clocks were supplied to the Government of Canada for their testing stations throughout the Dominion.

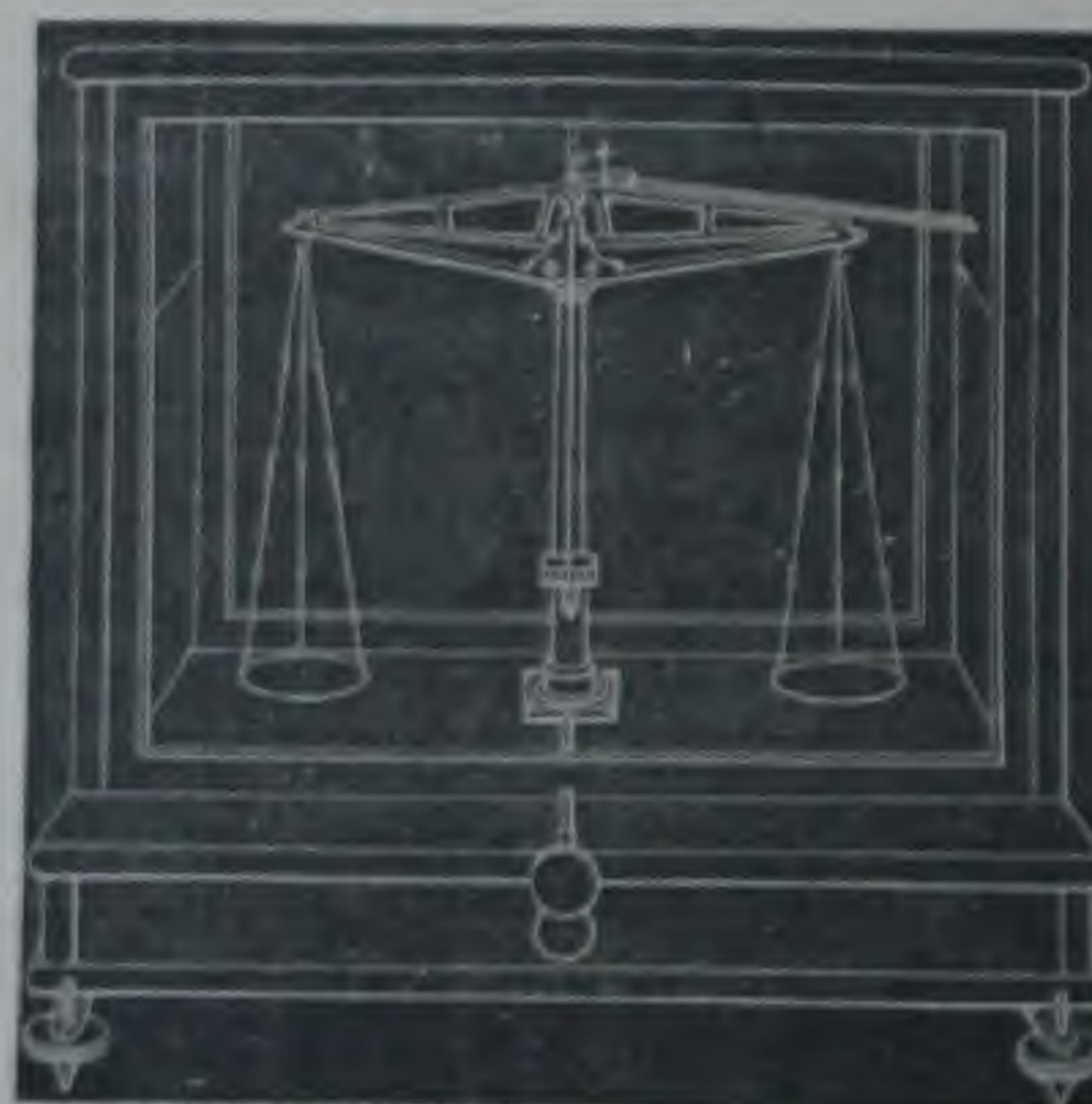
8 8 0

**Pendulum Clock** for photometrical experiments, 10 in. dial, dead beat escapement, centre seconds, and minute hand recording up to one hour, striking every minute. Mounted in mahogany case, with lacquered bezel, and glass front . . . . .  
5 10 0

**Experimental Clock**, of the very best quality and finish, as used with all our Standard Photometers; jewelled balance, lever escapement, with stopping and starting action; also device for re-setting the hands to zero; enamelled dial, with two circles divided into seconds and .01 of a minute respectively. Mounted in polished mahogany, ebonized, or oak case (fig. 4) . . . . .  
11 0 0

**Small French Spring Minute Clock**, with stop action and arrangement for bringing hands to zero, divided seconds and recording to 10 minutes . . . . .  
3 0 0

# CHEMICAL BALANCES.



**Balance** with 8-in. beam to carry 500 grains in each pan and turn with 1-50th of a grain. The balance standing on mahogany box with drawer . . . . .  
8 10 0

The same Balance with glass case . . . . .  
4 10 0

**Balance** with 12-in. beam to carry 1000 grains in each pan, and turn with 1-50th of a grain. The beam is divided for the use of the sliding weight. The balance standing on mahogany box with drawer . . . . .  
5 5 0

The same Balance in glass case with adjusting screws . . . . .  
7 5 0

**Balance** with 12-in. beam, to carry 1500 grains in each pan, and turn distinctly with 1-200th of a grain; the beam is divided; apparatus fixed in case for moving the sliding weight, short pan for taking specific gravities; glass case with adjusting screws. The beam of this Balance is constructed with straight knife edges at the ends, upon which the pans are suspended by agate planes, fig. 61 . . . . .  
9 15 0

Above Balance with beam, fitted with agate edges and planes, no steel used in construction; front of glass case sliding, with counterpoise weights . . . . .  
12 0 0

**Balance** with 14-in. beam, to carry 1500 grains in each pan, and indicate when loaded 1-1000th of a grain; the beam is constructed with knife edges at the ends, upon which the pans are suspended by agate planes; the centre also works upon a single agate plane; the beam is divided; apparatus for moving the sliding weight; pan for taking specific gravities; glass case with adjusting screws . . . . .  
17 5 0

**Balance** with 16-in. beam, to carry 1½ lbs. to 2 lbs. in each pan, and turn when loaded with 1-100th of a grain; the beam is divided; apparatus for moving sliding weight; glass case with adjusting screws . . . . .  
16 0 0

The same Balance with a beam with agate edges . . . . .  
18 8 0

## GRAIN WEIGHTS IN MAHOGANY BOXES.

Set of 1000 grains to 1-100th grain . . . . .  
" 600 " 1-100th " . . . . .  
" 600 " 1-100th grain, small box . . . . .  
12 0 0  
1 10 0  
1 4 0

## CHEMICALS.

	s. d.		s. d.				
Acid, Hydrochloric, sp. gr. 1·120, in stoppered bottle	1 lb.	1 8	Copper Sulphate	4 oz.	1 6		
" Nitric	1·880,	"	"	1 8	Hæmatin Tincture, in stoppered bottle with pipette	4 "	4 6
" Sulphuric	1·840,	"	"	1 8	Lead Acetate	4 "	1 6
Ammonia, Liq. Fortis, in stoppered bottle, sp. gr. ·880	"	2 0	Potash, pure	4 "	2 0		
" Sesquicarbonate, in jar	7 "	10 6	" yellow chromate, recrystallized	1 lb.	3 6		
Barium Chloride, pure recrystallized	1 "	2 0	Silver Nitrate	1 oz.	6 6		
Bromine, pure, in stoppered bottle	1 oz.	2 6	Soda, Caustic, pure, in bottle	1 lb.	7 6		
Carbon Bisulphide, in stoppered bottle	1 lb.	5 0	Pure Distilled Water	per carboy	11 0		
Cochineal Tincture	1 pt.	8 0	" "	per gallon (jar extra)	1 0		

## TEST SOLUTIONS.

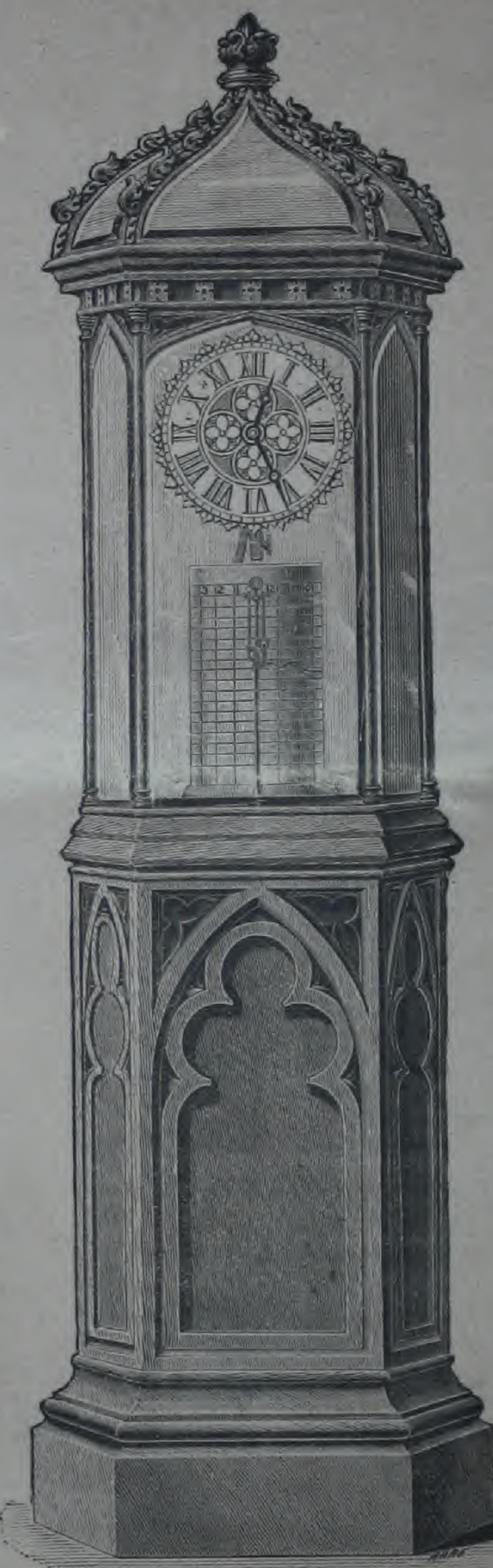
Referees' Sulphuric Acid Solution, 25 septems of which neutralize 1 grain of ammonia.	per Win. qt.	10 6
Referees' Ammonia Solution, containing 1 grain of ammonia 100 septems	per Win. qt.	10 6
Acid Solution, sp. gr. 1064·4, for Wills' Liquor Test	per gal.	10 6
Ammonia Solution, equivalent strength for ditto	"	10 6

Strong Caustic Soda Solution.	per Win. qt.	10 6
Barium Chloride Solution, containing 1,625 grains in a gallon.	per Win. qt.	8 0
Silver Nitrate Solution, containing 531·2 grains in a gallon.	per Win. qt.	10 6
Lead Syrup for Harcourt's Colour Test	per pt.	4 0

## SUNDRIES.

Cubes, graduated into millimètres	from 3 0 each
Sink's, graduated	3 6 "
Cylinder filled with glass beads.	15 6
Argand Burners	from 10 6
Porcelain	1 0 each
Platinum	35 0 per oz.
	from 3/6 to 12 0 "
	from 4 0 each
	6 6 "
complete	from 5 0 "
cubes	2 6 "
Platinum	30 0 "
Porcelain	2 0 "
ings	5 0 "
ll glass cover, and stand complete	16 0

Eardmann's Floats	1 6
Eudiometer Tubes	9 0
Flasks	from 1 0 each
Funnels	5 0 per doz.
" Holders	2 6 "
Ovens, Drying	30 0
Mohr's Pinch Cocks	1 0
Pipettes	from 0 6 each
Retort Stands	5 6 "
Test Glasses	1 0 per doz.
" Measure, graduated, on glass foot	3 0
" Mixers of every description	from 1 0 per doz.
" Tubes	0 6
" " Cleaners	from 1 0
" " Holders	1 0
" " Stands	1 0



Wright's New Design for Pressure Register.

JAS. W. QUEEN & CO.  
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PHYSICS & CHEMISTRY,

AGENTS IN UNITED STATES

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Balance

Balance

18 divia  
The same Balance with a box

GRAIN . . .

Set of 1000 grains to 1-100th grain . . . . .  
" 600 " 1-100th " : : :  
" 600 " 1-100th grain, small box : : :

16	0	0
18	8	0

£2	0	0
1	10	0
1	4	0

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CCA